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JULY, 1859.

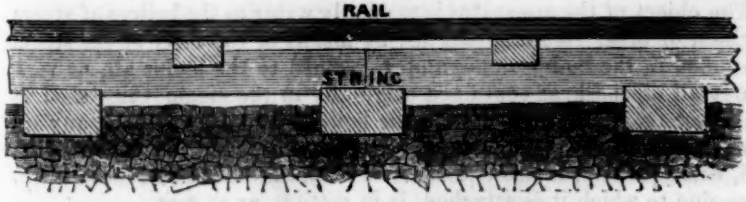
CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Suggestions Respecting the Superstructure of Railroads.

By JOHN C. TRAUTWINE, Civ. Eng., Philadelphia.

I would suggest to superintendents of railroads now in operation, the trial of a few rods in length of superstructure with string-pieces, and two sets of cross-ties, as shown by the following sketch. The bottom of the string-piece is supposed to be elevated about an inch above the ballast. It appears to me, that the elasticity insured to the rail *throughout its entire length* by this arrangement, will be found to diminish to a very great extent the destructive *pounding* action which the engines exert upon the rails of all the superstructures now in use. Experience would soon point out the proper dimensions and distances apart of the timbers to be employed for engines of any given weight, in order



to insure the requisite degree of elasticity, which evidently admits of being varied to any extent which may be found desirable. The increased quantity of timber involved in this proposed plan is a manifest objection to it; but experience only, can indicate whether the attend-

ant advantages which it possesses, may not more than counterbalance this objection, together with any others to which it may be liable. Beside the greater presumed durability of the rail, *from the fact that no portion of it rests on a rigid support;* we should secure a much more efficient rail-joint; inasmuch as the joints would rest *upon* the upper cross-ties, instead of *between* the ties, as is the present preferred practice; thus combining increased strength of joint, with greater uniformity of elasticity. We also should elevate the rail more beyond the influence of snow. Moreover, should this expedient enable us to obtain that certain (uncertain?) amount of elasticity of rail which all engineers concede to be so important a desideratum, it will doubtless lead to the adoption of more efficient supports for the lower cross-ties themselves;—supports which may extend below the influence of rain and frost; and thus effect a very important reduction of expense for rectification of the track,—beside dispensing with the use of ballast.

The great objection to the employment of such supports hitherto, has been the increased *rigidity of track* attendant on them, and by which the destruction of the rail is greatly accelerated. But if we can devise a means of modifying or entirely annulling this rigidity *in the rail*, by a process *entirely independent of the foundation on which the rail rests*, then this objection vanishes; and the way seems to open for arriving at a much more perfect superstructure than has hitherto been used.

I hope that the subject may be regarded by some of our intelligent superintendents as being of sufficient interest to induce them to make a trial of it, if only for a few lengths of rail; and to communicate the result through your valuable Journal.

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*Substitute for Feed Pumps and Donkey Engines.**

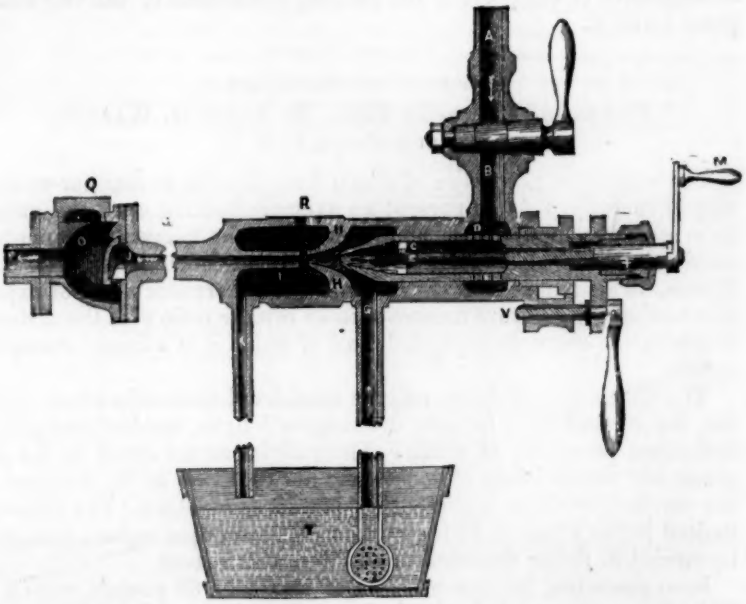
A very curious apparatus, called an *Automatic Injector*, invented by M. H. Giffard, and made by M. H. Flaud, the well-known engineer of Paris, has recently attracted considerable attention amongst scientific and practical men in France. The apparatus has been adopted by the Director General of Naval Construction in France; and has already been ordered by more than one well-known firm in the north of England.

The object of the apparatus is to supply water to the boilers of steam engines, or other steam apparatus, by means of the force of the steam contained in the boiler alone, and to return to the boiler all, or very nearly all of the heat contained originally in the steam thus used as the motor for supplying water to the boiler. It works without any aid from machinery; it is, in fact, perfectly automatic, as the title implies, and, consequently, it acts equally well when the steamboat, locomotive, or engine to which it is attached, is in motion, or at rest.

A B is the pipe bringing steam from the boiler; C D another pipe or chamber which receives the steam from the former through the holes at D—this latter pipe terminates conically; E F, small piston or rod

* From the Lond. Mechanics' Mag., April, 1859.

working by means of a screw or handle, F M; this serves to regulate or prevent entirely the passage of the steam; G is a suction water pipe. The water is drawn up into the chamber which surrounds the conical end of the steam pipe C D, and passes through the opening marked by an arrow between H H. The space left for the exit of the water is regulated by means of the lever and screw L, which moves the steam pipe, or chamber, C D, in either direction; I J, is a passage to carry the water to the boiler, together with the steam which communicates to the water a portion of the force with which it is charged by the pressure in the boiler; O is a valve to prevent the return of the water from the boiler when the apparatus is out of work; P leads directly to the boiler; Q is a screw stopper, to allow of re-adjustment or cleansing of the valve; K is a tube which carries off any superabundant water which may collect in the space around; I R is an opening with a sliding corner, through which the action of the apparatus may be distinctly seen; the steam and water combined forming a continual and rapid stream between the parts H and I.



To work the apparatus—the diameter of the water supply pipe being calculated to give the necessary amount of water—the rod E F is moved forward by the handle M, until the conical end of the rod stops the orifice of the cone. The steam cock in the pipe A B is then turned on; the screw handle M is then turned back a turn or so, to permit a small quantity of steam to pass. The steam in its rapid passage creates a vacuum in the chambers of the apparatus, and the water rushes up the pipe G into the space above. As soon as the water has entered, the handle is turned round so as to draw back the conical rod, and permit

free passage to the steam; the water is then carried rapidly into the boiler, and ceases to run off by the discharge pipe K.

The principle upon which the apparatus is based is, that as the pressure is equal upon all the interior surface of a steam boiler, and consequently as each unit of surface sustains the same pressure, if the steam is taken from the boiler into the apparatus by a larger orifice than that through which it is returned, the force of entry of the steam will be in greater proportion to the dimensions of the two orifices; or, in other words, steam brought from a boiler through a pipe of a given diameter, can easily be forced into the boiler again through the other end of the pipe, provided it have a much smaller aperture. In the machine in question, the entering orifice bears but a very small proportion to that of the supply pipe, because it is necessary to allow for the loss of force occasioned by the action of the water upon the steam.

In the above cut the apparatus is represented in a horizontal disposition, whereas it is now made vertical, but the only difference in the arrangement of the parts is the curving downwards of the two water-pipes G and K.

For the Journal of the Franklin Institute.

Mechanical Expansion Table. By James H. Warner, Engineer Corps, U. S. N.

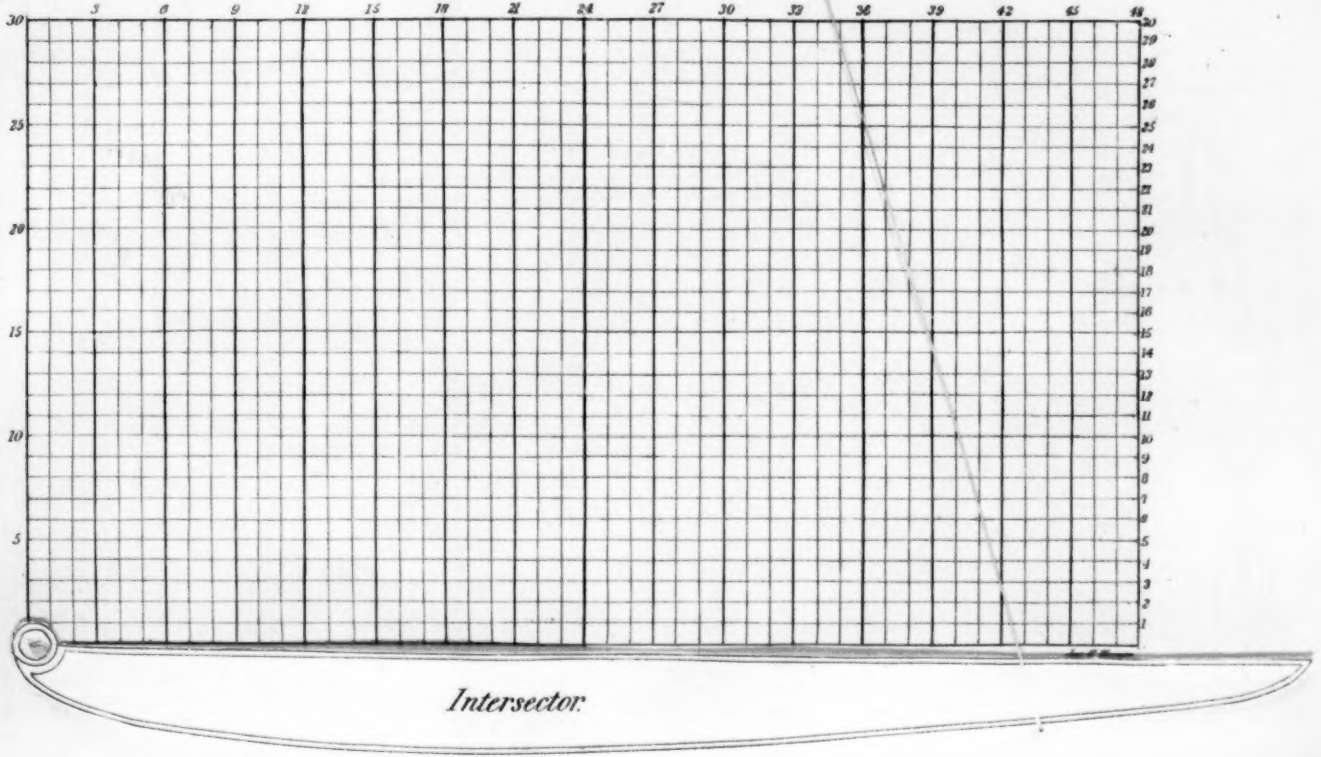
The expansive properties of steam have become so familiar to engineers generally, that to present an example bearing upon the subject may appear somewhat presumptuous. But the following is simply a *mechanical* method of doing that which is, perhaps, better done with figures. This table (Plate I,) is based upon Marriotte's law of expansion:—that the pressure decreases in an inverse ratio with the distance to which the steam is expanded, and of which it is a linear exemplification.

The dimensions of figure may be considered those of a steam cylinder, the vertical lines forming divisions of length, the horizontal lines indicating pressures of steam. These divisions are equal in the diagram, but the divisions of length are not required to be the same as the vertical, or those representing pressures of steam; and although limited in the Plate to 48 inches, and 30 pounds per square inch, may be carried in either direction to any desirable extent.

In explanation, let the pressure of steam be 30 pounds, cut off at 24 inches, and expanded to 48 inches, to find pressure at end of stroke. Bring the edge of the *intersector* to the junction of the vertical line corresponding to the distance to which the steam is expanded, and the *pressure line* 30. Then the point where the intersector cuts the vertical or *cut-off line* 24, indicates the pressure of steam expanded to 48 inches equal 15 pounds. The conditions being the same to find pressure at 36 inches, bring the intersector to the lines 30 and 36, representing pressure and distance. Upon the cut off line we find 20 pounds, the required pressure.

Suppose the pressure of steam equal 25 pounds, cut off at 8 inches,

MECHANICAL EXPANSION TABLE.



and expanded to 45 inches, bring the intersector to junction of pressure line 25, and distance line 45, we find upon the cut off line 8, the pressure 4, 4 pounds. The same pressure is required for any other pressure and distance. The intersector operating upon the *given* pressure line for any distance throughout the length, the *required* pressure will be indicated upon the cut off line.

This table constructed upon a larger scale will admit of decimal and other subdivisions, giving the pressure sufficiently correct for practical purposes.

The pressures as noted upon the cut off line are the ordinates to a hyperbolic curve corresponding to that degree of expansion.

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*Ye Anatomie of ye Engineere.**

The *Indian Punch* has the following:—Although an arch man, yet is he never forgetful of gravity; and though he damneth and blasteth more than any other man, he piqueth himself on being always correct in his terms: he is a dab at algebra, for which a Y Z is needful: he is a very Noah at describing arcs. Though he seeketh not after taverns he is conversant with sines, and payeth due attention to his cosines and sick Aunts. Even though not wealthy, he helpeth to establish many a bank. He, ever kind and hospitable, supplieth chairs for sleepers, and though addicted to rail is never forgetful of the tender: he is a dutiful subject and though often in hot water, ever payeth fit attention to the Governor. He is somewhat of an ornithologist, knoweth all about cranes and crows, kites, tumblers, and cocks for hengines, and moreover maketh wire ducks to aid his resonant steam eagles to fly. He is also somewhat of an entomologist, understanding flies, crabs, worms, and such likes, and not above taking notice even of a cows ticks. Though partial to hydraulics he is not otherwise a rollicking man, yet is at home in high dressed attics, where he often maketh use of new mattocks in his area speculations. He is a peaceful man, though well versed in triggernometry, and in the habit of making great use of switches in various ways. He is of levelling tendencies, yet sometimes wisheth he were monarch of all he surveyed. He is the most progressive of mortals, axing his way through forests and picking it through rocks, and, paradoxical as it may seem, he opens a country by putting locks on the rivers and keys on the banks. He is by no means a hater o' docks man, but well versed in dry dock trinal subjects, and would never desire to pull down the church unless it stood in the way of a railroad. He reverenceth the institutions of his country, because in them he recognizeth the mechanical powers. The Press he rightly regardeth as the lever; the ten-pound voters as the small end of the wedge; the House of Lords as the inclined plane, and the Commons as the screw: the Army he conceiveth to be both hammer and tongs combined, the Navy a series of pulleys, and country justices in general pumps. His affection for the constitution is unbounded, for he only regards it in the light of the common wheel.

* From the London Builder, No. 846.

*On the Burning of Welsh Steam Coal in Locomotive Engines.**

By J. TOMLINSON.

[Read at the Institution of Mechanical Engineers.]

The use of coal in locomotive engines having become almost the rule, the writer offers the following results of a series of trials he has made with the steam coals of South Wales, in locomotive engines upon the Taff Vale Railway, in comparison with the best descriptions of coke to be had in the same district; as there has hitherto been a difficulty in the use of that description of coal for such a purpose almost amounting to prohibition, from the fact that in all previous trials a failure has resulted from the burning of the firebars. This failure of the Welsh steam coal in locomotive engines has been hitherto attributed to the firebars becoming clinkered over; but the results of the trials described in the following paper appear to show that the failure has arisen from an entirely different cause, and one that can be completely obviated.

The writer was originally driven to the use of coal alone for carrying on the traffic of the Taff Vale Railway in January, 1858, in consequence of the continued strike of the colliers in the Rhondda Valley, where the coking coal is obtained. Previous to that time little or no coal had been used in locomotives, owing to the good quality and low price of the coke; and from the idea that coal could not economically compete with coke for the heavy work of this line, and also from the known difficulties to be overcome in its employment. The transition from coal to coke being sudden and unprepared for, it became necessary to watch the matter closely, so as to determine which of the various descriptions of coal would answer the purpose best, and to arrange its treatment; more especially as at the outset, from the various qualities of coal that had to be used, the firebars were continually being burnt out, and seldom could be made to last two days without passing through the hands of a smith to be separated and straightened; even then several bars a day were totally destroyed in each engine, some engines having had two entire new sets a day to run 100 miles. After careful consideration of the subject it was decided to use only one description of coal; the preference was then given to the steam coal over the bituminous, as being more pure in its composition, and smokeless; and after attentive observation and trials the Aberdare Four Feet Vein coal was chosen. With this coal it was found that the least damage was done to the firebars, and the best result obtained by working the engine with a very thin fire, say not exceeding 9 inches with a moderate load, and slightly thicker as the load increased, not however exceeding 15 inches in any case. In working with a light train or down hill with a loaded train, it was found advantageous to keep even a more shallow fire than 9 inches; for the blast being very light (as little or no traction is required down hill on this railway), the supply of steam could not be kept up unless the air were admitted with little difficulty; it is however necessary to be prepared in case of being stopped, and

* From the Lond. Civ. Eng. and Arch. Jour., May, 1859.

therefore a bright fire was a desideratum which could not be obtained unless it were kept thin.

The injury to the firebars was however still a great item, notwithstanding all the care that could be bestowed on them; for it is difficult to get a number of men to attend implicitly to rules which give them more trouble than they have previously been accustomed to. The writer therefore was induced to try an experiment by covering up the entire surface of the bars with small pieces of firebrick, not exceeding 3 ins. cube, and putting the fire on them, so as to prevent the direct action of the fire on the iron of the bars; and it was found that from the clean nature of the coal no bad result took place in the generation of steam, while the bars now received little or no injury. This plan has consequently been generally adopted, but with the partial substitution of clinker from stationary engines instead of firebrick alone. It has completely obviated the difficulty of the bars being burnt, and a set of bars will now last on an average four months, running about 100 miles a day. It is also attended with a beneficial result; for the small coal, instead of passing directly into the ashpan unconsumed; adheres partially to the red-hot brick and clinker, and is consumed; and notwithstanding that the Welsh steam coal falls readily to small, and has little if any binding property, the engines can run 100 miles without cleaning out the ashpan. Another description of coal containing a larger percentage of ash has also been tried for getting up steam and making the first fire to start with, which clinkering slightly on the bars most effectually protected them from burning: the use of this coal was however limited to 5 cwt. per day for each engine.

To place the engine more out of the control of the men, the plan was adopted which had been in use on other engines, of perforating the shield of the firedoor and drilling five or six two inch holes in the door itself, so as to admit a little air above the fire; this was found useful not only in assisting combustion, but also in preventing the blast from lifting the small particles of coal and thereby choking the tubes.

Having so far succeeded in efficiently working the traffic entirely with coal, and finding the engines were working the trains with a smaller weight of fuel than they had previously done, the writer was disinclined to return to coke without good reason, after the experience he had had. A series of experiments was therefore made to test the commercial value of each description of fuel. The first series of experiments was made with an engine working the regular mineral trains, with Aberdare Four Feet coal and Rhondda Valley best coke: the second series, with the same coal and coke, with a special train of thirty-five loaded coal wagons weighing 269 tons, run at the regular speeds of the ordinary trains of about 11½ miles per hour: the third series, with various fuels, with a special train of forty loaded coal wagons weighing 314 tons, run at a speed of twenty miles per hour up the hill and twelve miles down (twelve miles per hour being the limit down hill with loaded trains): and the fourth series, with bastard steam coal and Aberdare Nine Feet coal: the former of these has a larger percentage of ash and more bituminous property, the only objection

to its use being the smoke: it does not burn the bars, and is fully as economical as the pure steam coal.

The whole series of experiments were made with the same engine and by the same engineman. The engine is of the following dimensions: cylinders 16 inches diameter and 24 inches stroke; six wheels coupled, 4 ft. 6 ins. diameter; firebox 3 ft. 6 ins. square by 4 ft. 10 ins. high; 156 tubes, 13 ft. 3 ins. long by 2 inches diameter, and No. 11 to No. 14 wire gauge thickness; safety valves loaded to a pressure of 110 lbs. per square inch.

The following table gives the general results of the whole of the experiments, showing the quantity of fuel consumed per ton per mile, the quantity of water evaporated per pound of fuel, and the average speed of the train during running:—

Description of Fuel.	Fuel consumed per ton per mile.	Water evaporated per pound of fuel.	Speed in running miles per hour.
	lb.	lbs.	miles.
Coal—Aberdare Four Feet Vein, .	·127	7·63	11·5
Coke—Rhondda Valley Best Coke,	·172	7·62	11·5
Coal—Aberdare Four Feet Vein, .	·130	8·37	11·5
Coke—Rhondda Valley Best Coke,	·124	8·34	11·3
Coke—Rhondda Valley Best Coke,	·136	7·54	16·8
Coal—Aberdare Four Feet Vein, lump,	·133	7·73	16·5
Coal— " half lump and half small,	·153	7·11	14·8
Coal—Rhondda Valley Bastard Steam Coal	·110	8·63	11·5
Coal—Aberdare Nine Feet Vein, .	·112	8·15	11·5

The results in the consumption of fuel showing in all cases slightly in favor of the coal, they may fairly be considered equal; and as the abuse of the engine when burning coal is more easily detected than when using coke, this forms a further advantage in favor of coal. The preference may also be given to coal over coke for the freedom in generating steam, which will allow the blast pipe to be of larger dimensions than when burning coke. This has been clearly shown, as the engines are now maintaining steam at 100 to 110 lbs. per square inch with coal, with the same sized blast pipes as were used previously for 80 lbs. with coke; and the firebars have also been placed closer together, the air spaces being reduced from 1 inch to $\frac{5}{8}$-inch. Hence the writer thinks it may be concluded that the Welsh smokeless coal may be economically used in substitution for coke; and that where failures have taken place previously, they are to be attributed to the very great heating power of the coal; and that the difficulty with firebars has resulted not from clinker, but from the absence of a proper protection for the iron of the bars, so that with heavy firing the heat has struck downwards and fused the bars themselves.

Nearly all the engines on the Taff Vale Railway are now burning Welsh steam coal entirely; they take with each train a load of eighty empty wagons averaging 3¼ tons each or 260 tons total, up an average rising gradient of 1 in 309, at from 13 to 14 miles per hour without any inconvenience.

The composition of the Aberdare Four Feet Vein, the coal now in use in these engines, is

Carbon,	90·25
Hydrogen,	4·12
Oxygen,	2·25
Nitrogen, &c.,	2·13
Ash,	1·25
	100 00

It is therefore practically coke, and requires only proper treatment for substitution in the place of coke. Another great advantage in the use of this coal over all others in locomotive engines is its almost entire freedom from smoke, thus rendering any plan of smoke-burning unnecessary, not even a steam jet being required when the engine is standing.

The advantage of slow speed is so distinctly shown in the results obtained that the writer considers this point as worthy of more attention than it usually receives on railways; for a slow speed not only economizes the quantity of fuel consumed by diminishing the resistance of the train, but also increases the evaporative duty obtained from it.

Discussion.—Mr. Tomlinson explained that the firebrick was merely broken up into small pieces of about 3 inches cube, and thrown in roughly with a shovel in a single layer over the grate, so as to cover the firebars; it was found to last a long time, and in one special trial that he had made to ascertain its durability the fire was not dropped for six days, the engine running continuously 100 miles per day, and at the end of that time the firebrick still remained as an efficient protection for the grate bars. The thickness of the fire was an important point: it might be 9 or 10 inches thick at the sides, where the absorbing surfaces of the firebox kept down the temperature; but should be as thin as possible in the centre, so that the bars could just be seen through it, for the bars would go down in the centre in spite of all precautions, unless the fire was kept very thin, on account of the intense heat. By the experiments the injurious effect of increased speed was remarkably shown, not only in increased consumption of fuel, but also in diminished evaporative duty of the fuel, which was reduced about 10 per cent. by an increase of speed of 5½ miles per hour, or about 50 per cent. In the trial that he had made of Newcastle coal, he had found that the bituminous Newcastle coal demanded very different circumstances for its economical consumption, requiring a much greater supply of air; it consequently received imperfect treatment in ordinary locomotive fireboxes, where no provision was made for an extra supply of air beyond that admitted through the grate; so that the evaporative duty obtained in the trial was only 5¼ lbs. of water per pound of fuel.

The results of the trials in consumption per ton per mile were not always thoroughly reliable as a means of comparison, on account of the great fluctuation in the weight of trains down, some being as much as 700 or 800 tons down hill, which would materially affect the result; the fall was nearly uniform from one end of the line to the other, amounting to 409 feet in 24 miles, or an average gradient of 1 in 309. The coke cost 12*s.* 6*d.* per ton and the coal 6*s.* 8*d.* per ton in the wagons upon the railway; so that the cost of fuel when coal was used was little more than half of that with coke, as the consumption was about the same in quantity to do the same work.

Mr. R. LAYBOURN said he had made some trials of burning Welsh coal in locomotives on the Monmouthshire Railway, about eighteen months ago, with coal from Nixon's Deep Duffryn seam, the same seam of coal as the Aberdare Four Feet Vein, but found the bars came down in the way described: this was obviated by using inferior coke for lighting the fire, which formed a portion of clinker over the bars that served to protect them; by this means he succeeded in using the coal. He had made a series of experiments, which led him to the adoption of a considerable proportion of coal mixed with the coke for the locomotives on the Monmouthshire Railways. In the half year ending December, 1855, and previously, coke alone had been used, at an average rate in that half year of 40 lbs. per mile for all the trains, passenger and goods, costing 3·12*d.* per mile of the trains for fuel. In the following half year to June, 1856, a quantity of coal was mixed with the coke; and in the next half year to December, 1856, this was increased to an average of 22·73 lbs. of coal per mile and 17·85 lbs. of coke, making a total consumption of 40·50 lbs. per mile, at a cost of 2·56*d.* per mile of the trains for fuel. The proportion of coal was then further increased, and the results were:—

In the half year ending	Coal.	Coke.	Total Consumption.	Cost of Fuel.
June 1857,	39·25 lbs.	5·60 lbs.	44·85 lbs. per mile.	2·09*d.* per mile.
Dec. 1857,	39·71	5·20	44·91 "	2·13 "
June 1858,	34·15	7·21	41·36 "	2·10 "

He had not tried firebrick, but by getting up the fires with inferior coke a clinker was formed over the grate, which was found to answer the purpose of protecting the bars.

Mr. TOMLINSON said that the weights given in the tabular statement of experiments were those of the trains alone, independent of the engine and tender, which would add about 45 tons, the engine being about 29 tons weight and the tender 16 tons.

Mr. B. FOTHERGILL had been engaged recently in experiments on this subject, and he agreed entirely with the statements in the paper, as to the efficiency of coal for locomotives in place of coke; and that the quantity of coal required was not greater to do the same work, if suitable provision was made for its proper combustion. His experiments had been made with the partially bituminous coal of Lancashire and Yorkshire; and he had also made one trial with the Welsh smokeless coal in a locomotive engine, but it was impracticable to complete that trial in consequence of the firebars melting down upon the trip, so as

to stop the engine after having run only a short distance. It was not from defect of the coal that this stoppage of the trial took place, but entirely from the melting of the firebars; and it was evident that without some provision for protecting the bars from melting, the Welsh smokeless coal could not be employed in locomotives. In two trials he had made, the cost of fuel for taking the same train over the same distance of 96 miles was found to be with coke at 11*s.* 6*d.* per ton, 22*s.* 3*d.*; with coal at 5*s.* 3*d.* per ton, 9*s.* 5*d.*; showing a saving of 57 per cent. in the cost of fuel consumed when coal was used. Locomotive engines using coal might always be made to burn their smoke satisfactorily. A point of great importance was the relative durability of the boiler tubes and firebox with coal and with coke; and after the practicability of using coal with great economy in cost of fuel had been established, this became a serious question in deciding whether to go on making coal-burning engines instead of coke engines. It had been feared at first that there would be a loss from more rapid destruction of the brass tubes and copper firebox with coal than with coke; and he had been recently engaged in an investigation of the subject on the London and South Western Railway, where coal-burning engines had been worked for a long time, for the purpose of ascertaining the real lifetime of the tubes under the two circumstances. The result was found to be that in twenty-six coke-burning engines the average duration of a set of brass tubes was 94,518 miles, varying from 65,000 to 127,000 miles, according to their quality, and the description of coke used. But in several engines running with half coal and half coke, the tubes had run 154,955 miles, and were still in good working condition; and in one of these engines the tubes after 137,676 miles work were not half worn out, and were reduced in thickness only from No. 13 to No. 16 wire gauge, or from ·095 to ·065 inch. From the results of this investigation he was satisfied that the ordinary wear of the tubes was caused mainly by the cutting and abrading action of the hard particles of coke drawn rapidly through the tubes, and was not entirely a chemical action as had been at first supposed; and consequently the comparative softness of the particles of coal greatly reduced this cause of wear. This was illustrated by the wear that ordinarily took place in the fire boxes of coke engines, in which the roof and upper portion were reduced only $\frac{1}{32}$-inch in thickness, whilst under the firedoor and at the lower part of the sides, where exposed to the continued wear of the hard pieces of coke, the thickness became reduced $\frac{1}{8}$-inch in the same time. He was satisfied that the durability both of tubes and fireboxes would prove much greater with coal alone; and that there was no ground to fear more chemical action from sulphur with coal than with coke.

Mr. Tomlinson said that the quantity of sulphur in the Welsh steam coal was very small, and was included in the 2·13 per cent. of nitrogen, &c.; in the Four Feet Vein the proportion of sulphur seldom exceeded from 1 to 1½ per cent., and was never more than 2 per cent.

Mr. W. G. Craig said he was satisfied that the tubes had a much greater durability with coal than with coke. For the purpose of burning coal he had used a firegrate constructed with each alternate bar

raised one inch above the others, making a kind of hollow fire, leaving spaces for air to enter under the fuel; the bars were not found so liable to burn in that arrangement as with a level grate, being protected by a greater supply of air on their top surface; a set of bars now lasted several weeks with coal, instead of only one week as before when they were all level.

Mr. J. FENTON observed that the low evaporative duty obtained from the Newcastle coal, when burnt without consuming the smoke, showed the great importance of insuring a sufficient supply of air for bituminous coal, and a considerably larger quantity than was required for a coke fire.

Mr. W. SMITH remarked that he had seen a construction of cast iron channelled firebars by Mr. Gray, in an application of which every alternate bar was raised about 1½ inches above the rest: sloping notches or channels were made across the top edges of the bars, to afford an increased area for supply of air; several sets were at work in London, burning coal, and they appeared to answer satisfactorily, giving an increased supply of air, and lasting longer than the ordinary bars from the greater cooling effect of the air.

Mr. TOMLINSON said he had tried a set of Mr. Gray's firebars for a stationary engine grate under a large Cornish boiler, but had not found there was much advantage over a set of thin cast iron bars which he had tried in a companion boiler of the same description; the latter bars were 3¼ inches deep by ¾-inch thick at top and ½-inch at bottom, with ¾-inch spaces. In both boilers the firedoors were perforated in the same manner as the locomotive firedoor, and provided with sliding shutters to close the air holes; there was also a damper below the fire to shut up all close when the incline was not being worked. He thought that in practice the channels across the bars were more frequently filled with dust than clear, and hence the absence of any good effect resulting from them. The bars that he used for locomotives were wrought iron, 4½ inches deep by ⅞-inch thick at top and $\frac{5}{16}$-inch at bottom, and ⅝-inch spaces when new. In some engines the same set had lasted five months when burning about 45 lbs. of coal per mile and running about 500 miles per week: their average duration was about three months, which was gradually increasing.

Mr. R. LAYBOURN observed that an important consideration in the matter was the great variation in the quality of coal obtained in different districts, so that a special plan had to be arranged on each different railway to suit the coal to be used there. He had made a trial of a plan of firegrate by Mr. Jeffreys, of the Shrewsbury and Hereford Railway, in which the bars were laid flatways on the side instead of the edge, with air spaces between, and partly overlapping one another, forming a gradually sloping surface from each side of the firebox down towards the centre; this arrangement proved successful in admitting a larger supply of air, and he found it effective in burning the bituminous coal.

Mr. MAUDSLAY observed that this was similar to Mr. Crampton's firegrate, that was used on the French railways, except that in the

latter the bars were laid transversely instead of longitudinally in the firebox, forming a surface sloping down from the firedoor towards the tube plate.

Mr. E. A. Cowper observed that in Mr. Gray's plan of firebars that had been referred to, the general arrangement he believed was to have $\frac{1}{2}$-inch bars and $\frac{1}{2}$-inch air spaces, giving 50 per cent. area of opening in plan for the admission of air; but the effective area was increased to 60 or 70 per cent. by cutting sloping notches in the top edges of the bars, so that portions of the top surface of the bars were cut away. He did not know what were the results of their working, but thought the use of very thin bars fully answered the purpose required; he usually employed bars only $\frac{1}{2}$-inch thick at top and $\frac{1}{4}$-inch at bottom, with $\frac{5}{8}$-inch spaces.

Mr. Tomlinson said that a set of Mr. Gray's firebars had been tried for some time in the "Iron Duke" locomotive engine on the Great Western Railway; but he did not think any plan of stepped grate would be suitable for burning the Welsh coal, for he found that if any one of the ordinary bars was accidentally left standing up above the others, from the notch in the firebar frame not being cleaned out, it was sure to get burnt more than the rest.

Mr. E. A. Cowper had heard that a plan had recently been tried in some locomotives on the Great Western Railway, for tipping up the entire firegrate upon a centre bearing, so as to allow of laying the fresh fuel on the bars, and then covering it over with the red fire when the grate was tipped back again sharply.

Mr. R. Laybourn believed that was Mr. Jeffreys' plan, and was intended as a mode of making cast iron bars suitable for locomotive firegrates; this was effected by never disturbing the cast iron bars on their bed, and they were never removed until worn out; but when the fire had to be dropped the whole frame was tipped over on a centre bearing, allowing the fuel to drop out. This plan gave great economy in the cost of maintenance of firebars, as cast iron was used instead of wrought iron bars; and the bars were preserved from injury by avoiding the handling of them whilst hot, which was liable to bend or break them.

Mr. J. Fernie said an arrangement of ridged firebars had been tried for a stationary engine boiler at Derby, on Mr. Chanter's plan, in which the top of the bars was ridged or serrated, and every alternate bar was moved longitudinally about 1 or $1\frac{1}{2}$ inch backwards and forwards, the intermediate bars remaining stationary; the alternate bars were moved by a transverse shaft provided with a lever, which was moved occasionally by the stoker. These had been in use about two years, and were found to answer the purpose satisfactorily; the ridges on the bars served to keep the fire gently stirred, preventing clinkers from adhering to the bars.

Mr. W. G. Craig observed that for burning coal it was requisite to have the bars rather close together and very thin, considerably more so than with coke; and the object he had in view in using a grate with the alternate bars raised above the others was to admit more air under

the fuel, making a kind of hollow fire, to prevent the bars from burning. The firebars he used were $\frac{1}{8}$-inch thick at top and $\frac{1}{2}$-inch at bottom, with $\frac{3}{4}$ to $\frac{1}{8}$-inch air spaces, and when placed alternately raised, they could be brought still closer.

Mr. J. E. CLIFT inquired whether a pan of water had been tried under the firegrate, to prevent the bars being burnt; that plan was frequently used in stationary engines with good results, and by this means he had had firebars in constant use for two years with intense coal fires under gas retorts, without the bars burning away. There was constantly a supply of water under the firegrate, and the steam rising from it served to keep the bars continually protected and cool.

Mr. TOMLINSON said he had tried a jet of water from the boiler kept continually running under the firegrate of a locomotive during the whole trip, but it did not serve to protect the bars from burning; he had not tried a pan of water, but with the jet there was so much water constantly supplied as to keep the ashpan full of steam, and he thought the effect would be the same as in the use of a pan of water.

Mr. C. W. SIEMENS observed that the efficiency of the water below the firegrate would depend a good deal upon the quantity of ashes falling from the fire; if the ashes fell easily they would keep up a supply of steam from the ashpan and preserve the bars from injury; but if much clinker were formed on the firegrate, the water pan would not answer, as there would not be steam enough to keep the bars cool.

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*On a New System of Axle Boxes, not requiring Lubricating, and without Liability to Heating.** By ALPHONSE DE BRUSSAUT.

The author first recapitulated the liability to accident arising from inattention to the constant greasing of the ordinary axle boxes and journals of carriages and of machinery, the inconvenience of accumulating dust and grit on the bearings, and the friction and wear and tear arising from these causes. He then reviewed the numerous inventions and attempts to remedy these evils, showing that none of them had hitherto successfully abolished the necessity for the expensive and uncleanly use of some lubricating matter. He next proceeded to describe the system which he had introduced, and had applied somewhat extensively in France to various classes of machinery in which the use of grease had hitherto been considered indispensable. The new apparatus was described to consist of a series of four, six, eight, or any other convenient number of cylindrical rollers of the length of the journal, retained at certain distances apart from each other, yet still united by elastic bands of vulcanized india rubber. These rollers, thus united, and placed around the journal, would be set in motion by the pressure of the axle, without the possibility of collision with or friction against each other, or of rubbing upon the surface of the journal or of the bearing, and thus avoiding as much as possible any friction or opposi-

* From the Lond. Civ. Eng. and Arch. Journal, May, 1859.

tion to the motion of the journal. The action of rolling being thus substituted for sliding, there could not be any abrasion of the substances, and lubricating became unnecessary. The machines so fitted were stated to work with remarkable ease and steadiness, and to be set in motion and the speed to be kept up with considerable facility. No inconvenience had been experienced from the fracture of the elastic bands and shafts, making 450 to 500 revolutions per minute, working perfectly well, without any symptom of heating.

The reasons for this action were stated in a plain and comprehensive manner by showing that in moving a body of an octagonal form along a plane the action must be either by sliding or by rolling; in the former lubrication was necessary, whereas in the latter the presence of any lubricating matter would be prejudicial. Extending the latter principle to the cylindrical form, which was merely a body having an indefinite number of sides, it was evident that by retaining these cylinders apart by means of the elastic bands, so as to avoid friction against each other or upon the journal or the bearing surface, a practically perfect rolling motion would be obtained, and it was contended that by M. Brussaut's system the two material results of rapid rotation without heating, and a complete suppression of the use of grease in all journals of machinery were arrived at.

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*Cheap Railway Fare.**

We see by the time tables that the South Western Company are carrying passengers in covered carriages on Sundays to Portsmouth and back for 4*s.* each. We do not say that this is any thing extraordinary for a railway company in these days to do, but as the distance to Portsmouth is 94½ miles, a passenger is thus carried 189 miles for 4*s.*, or just about ¼*d.* per mile, which surely is cheap enough.

It is difficult to run a train, especially a long one, for less than 2*s.* per mile, including every expense commercially chargeable against it. It would therefore require 200 passengers at ¼*d.* per mile per passenger to be in a train, in order to work at about 50 per cent. expense; to net half the receipts as profits. We do not know how many passengers these very cheap trains (to Portsmouth, Salisbury, &c.,) average, but we dare to say it is not less than 200. It is work almost as cheap as carrying coals at ½*d.* per ton per mile. If no more passengers than 200 are found in such train, it is in point of fact cheaper than coals at ½*d.* a ton a mile.

Such cheap fares are calculated to render railway traveling popular, and if the million can be attracted to the railway, benefit will follow to the railway companies and the public, for nothing is more healthy than a trip every now and then in the country, and as it is the case, that as many as 500 or 600 persons can be easily conveyed in one train, fares of only ¼*d.* per mile per passenger would be handsomely remunerative obtained from a train filled with so many passengers.

* From Herapath's Railway Journal, No. 948.

AMERICAN PATENTS.

List of American Patents which issued from April 19 to May 10, 1859, (inclusive,) with Exemplifications.

APRIL 19.

216. Steam Boiler Furnaces; Jonathan Amory, West Roxbury, Massachusetts.

Claim—The method of increasing the combustion and protecting the combustion curves, as described.

217. Device for Converting Alternate Circular Motion into Direct Circular Motion; Abraham Bartholf, City of New York.

Claim—The dog, spring, and lever, combined and arranged relatively to each other and applied to the wheel, or its equivalent, as described.

218. Burial Cases; A. C. Barstow, Providence, Rhode Island.

Claim—Constructing a metallic burial case with the ogee-shaped ends, whereby great reduction in weight and economy in the manufacture is secured, and at the same time all the space required afforded. Also, forming the metallic case with the overlapping strengthening ribs.

219. Furnace for Heating Tire; M. Battel, Albany, New York.

Claim—A furnace, composed of an annular body, fire space, central tube, with cover or damper therein, to regulate the draft, extension, rod, crane, top, and otherwise constructed as described.

220. Anchor Tripper; T. L. Baylies, Richmond, Indiana.

Claim—The arrangement and combination of the tripping bar, shaft, and cams, as described.

221. Machine for Filing Saws; A. M. Beardsley, Elkhart, Indiana.

Claim—1st, The arrangement of the swinging frame of the file carriage upon the adjusting plate, so that it can be turned over and supported upon the bed-plate, in the manner described. 2d, The arrangement of the check pieces upon the adjusting plate, between the arms of the swinging frame, for the purpose of bracing the latter against the thrusts of the file carriage, while said frame is free to rise and fall. 3d, The arrangement of the gauging screw in the cross-piece of the swinging frame, by which the teeth are filed to a uniform depth, without interfering with the rising of the file carriage, to conform to the taper of the file. 4th, The arrangement of the seats at each end of the bed-plate, whereby the implement may be supported directly upon the clamp of the saw.

222. Artificial Legs; Douglas Bly, Rochester, New York.

Claim—The use of an elastic strap or apparatus from the shoulders, or upper part of the body, when attached to the artificial leg in such a manner that its contractile power is exerted in connexion with the backward motion of the shoulders, to produce the forward motion of the foot.

223. Washing Machines; Benjamin Bradbury, Abington, Illinois.

Claim—The arrangement of the levers and pitman moving the dashers over the concave of the box.

224. Faucets; C. K. Bradford, Lynn, Massachusetts.

Claim—The faucet, to be operated by applying pressure directly to the head of the case, said case for this purpose being provided with an outside elastic diaphragm forming the head thereto, and combined with a valve rod, arranged in relation to the case internally, so that the ends of said rod terminate respectively at, and are secured to, the valve and diaphragm.

225. Bedstead; Wm. H. Bramble, Springfield, Ohio.

Claim—1st, The combination of an under and upper section, united to each other by springs and links, so that the upper section may have a free, vertical, and horizontal motion. 2d, In combination with a bedstead made of two sections, the making of the posts of the upper section shorter than the supports of the under section, so that said upper section, when placed on the lower one, shall be entirely clear of the floor. 3d, The combination of the loose slats, springs, and webbing, when said webbing runs longitudinally or lengthwise of the bedstead.

226. Cooking Range; B. Wells Dunklee, Boston, Massachusetts.

Claim—The arrangement of the two induction flues, the gauge throats, their plates or bars, and the flues around and between the two ovens, a single damper, and its openings, being placed over the middle flue, and with respect to the two flues.

227. Governor for Steam Engines; John Broughton, City of New York.

Claim—Effecting the connexion between the ball arms and the central rod, by means of two levers and two links, applied and operating as set forth.

228. Lubricator; P. G. Brown, Schenectady, New York.

Claim—The combination of the reservoir, provided with a discharging aperture, valve, having a receiving aperture in it, and air chamber, or the equivalents thereof, when said air chamber is arranged to control or assist the discharge. Likewise, giving to the valve which conveys the oil from the reservoir to the discharging aperture an intermittent revolving motion, in one and the same direction, for and by the action of the handle, in either direction of the travel of the latter, or in reverse directions thereof.

229. Lock; George Clay, City of New York.

Claim—The arrangement of the following parts for united operation in a lock, viz: right and left double-walled case, sliding right and left key-hole guard plates, right and left forked bars, main and auxiliary tumblers, and bolt.

230. Railroad Car Brake; Wm. E. Cooper, Dunkirk, New York.

Claim—The arrangement of the bell cord, pulleys, and movable pulley block, with the brake cord, connected and operated for the purpose of setting all of the brakes in the entire train, simultaneously and from any point within the train.

231. Journal Boxes; Rienza Daniels, Almena, Michigan.

Claim—The axle furnished with a screw-tapped arm, and having toothed and plain sections of a journal

arranged and clamped upon it, in combination with the internally toothed journal box, and with rods, toothed and plain sections of frictional rollers, arranged and clamped on them, in the manner described.

232. HARVESTING MACHINE; George Esterly, Whitewater, Wisconsin.

Claim—1st, The adjusting of the rake by means of the socket, suspended by journals or trunnions, and secured in the desired position by set-screws and bars, or their equivalents, in combination with the adjustable platform, whereby the rake and platform may be adjusted to suit the height the grain is being cut. 2d, The segment plate with the curved flanch, for the purpose of carrying the rake backwards. 3d, The use of the pendant rod or bar provided with the rollers, in combination with the flanch. I do not claim the guard finger—but I claim, fourthly, attaching the guard finger to the bearing, in the manner described, whereby it may be adjusted, for the purpose specified.

233. MACHINE FOR QUARRYING STONE, &c.; Jonah Ellis, near Warrington, England; patented in England, December 6, 1855.

Claim—A portable apparatus, designed for cutting grooves in rock, or other mineral substances, for the purpose of quarrying the same in blocks, and consisting of supports which are fastened to the rock and sustain an adjustable bed-plate and screw-shaft, upon which bed-plate and screw-shaft a tool stock and adjustable cutter is made to traverse between two previously drilled or open spaces which form the extremities of the proposed cut.

234. WATER-COOLER FOR STEAM ENGINES; Robert G. Eunson, City of New York.

Claim—The use or employment of a decalorator, such as is described, or its equivalent, when the series of very small horizontal tubes are so arranged in respect to the current of water outside of the tubes, that the centre of each tube, in one row, shall be opposite, or nearly opposite, to the centre of the space between the tubes in the next row, in combination with supporting and directing tube plates, as described. Also, the use or employment of tubes, arranged in rows, in combination with the tube plates and shell of the decalorator, when so arranged that the current of cold water is made to flow across the tubes, being directed by the tube plates from side to side or from top to bottom, and from bottom to top of the shell, and around the tubes, being made to encircle them by its current, in consequence of their arrangement of rows, and at the same time, progress lengthwise of the shell and tubes in a direction contrary to the stream of fresh water inside of the tubes, for the purposes set forth.

235. FIREMAN'S LADDER; Daniel Fitzgerald, City of New York.

Claim—1st, The applying the tanks, or their equivalent, to ladders, with or without water, to elevate and hold said ladders, as described. 2d, Conveying the water through a long distance by an elongated pipe, or its equivalent, connected with the apparatus. 3d, Managing the curved or jointed pipes, by means of the lever, in the manner described.

236. MOULDS FOR STEEL CASTINGS; Perry G. Gardiner, City of New York.

Claim—1st, The constructing the mould with a cup or reservoir for holding all the melted metal for casting, closed and opened at the entrance of the sprue by the movable plug or stopper. 2d, The spherical hollow chamber, and air escape passage, and self-acting plug, to permit the rarified air to pass from the mould, and to escape, and to shut off the external air from the mould. 3d, The combination and arrangement of the two cups, the sprue, the figure, the tool or casting, and air-vents or passages, so as to form a bent tube by which the casting is filled from the bottom, and the external air excluded. 4th, The use of the moulds in a state of intense heat, never less than 500° Fahrenheit, and generally at a much higher temperature, for the purpose of producing, as nearly as practicable, a vacuum within the mould—but I do not claim the mere heating or warming of the moulds to produce a smooth casting, that having been a common practice heretofore.

237. MACHINE FOR SMOOTHING SOLES OF BOOTS AND SHOES; Othniel Gilmore, Raynham, Massachusetts.

Claim—The improved manufacture of a sole-smoothing or reducing wheel, made with the convex grinding annulus, concentric heel recess, and acute angled edges.

238. OVEN FOR COOLING CASTINGS; P. F. Geisse, Wellsville, Ohio.

Claim—The pipe, connecting the eyes or hubs of the wheels with flues and plate, for causing the current of air to pass through the eyes only of the hubs in cooling, in combination with heating oven and pits, operating as described.

239. MODE OF ATTACHING CASTERS TO TRUNKS; Isaac H. Giffing, City of New York.

Claim—The method described of constructing and attaching casters to trunks.

240. YOKE-RING ATTACHMENT FOR THE POLE OF OX-CARTS; James C. Gilbert, Leeds Junction, Maine.

Claim—The arrangement of the backing bearer and engaging notch of the spring-slider, with respect to, and to operate with, the draft hook.

241. ATTACHING CORDS TO WINDOW SASH; Porter A. Gladwin, Bristol, Massachusetts.

Claim—The employment of the slotted tension spring or plate, in combination with the cord and pulley, in the manner described.

242. WINDLASSES; Wm. P. Goolman, Dublin, Indiana.

Claim—1st, In combination with a winding drum or capstan of any suitable form, the application of a reel operated by the traction of the entering cable, to take up the slack from the said drum or capstan. 2d, In combination with the said reel and capstan, the adjustable idle pulley, operating to maintain the needful traction of the cable against the reel, or vary it as may be found needful.

243. PRINTING PRESSES; George P. Gordon, City of New York.

Claim—1st, The combination of one or more sets of revolving grippers with the finger stops, or their equivalents, for the purpose of piling the sheets of paper in an even and regular heap or pile. 2d, The combination of a vibrating feed-board with the rotating or revolving platen, for the purpose of feeding the sheets of paper regularly with precision at each rotation of the platen. 3d, The combination of a rotating reciprocating bed with a revolving platen.

244. BENCH PLANE-STOCK; Jackson Gorham, Bairdstown, Georgia.

Claim—Constructing the plane-stock of a central wooden portion secured between metal side-plates provided with flanches, the part, a', being permanently secured between the plates, and the part, a, rendered adjustable between said plates by set-screws.

245. COTTON GINS; Edward Gottheil, Galveston, Texas.

Claim—1st, The method of feeding the cotton bolls to the rollers, by means of a blast issuing from a

slotted or perforated tube. 2d, The arrangement of the two cylindrical brushes, in combination with the rollers, when the former are so constructed that a blast from an independent source may be forced through slots or perforations in their peripheries. 3d, The comb, in combination with the blast pipe, for gathering the lint off the upper brush roller and discharging it into its receptacle, in the manner set forth.

246. SURVEYORS' CHAIN; Josiah M. Grumman, Brooklyn, New York.

Claim—1st, The method of making civil engineers' and surveyors' chains of a peculiar form of link, as described. 2d, The arrangement of spring-balance and level in the same tube or covering, with the arrangements for adjusting. 3d, The method of allowing for the variation of the temperature by a scale of variation on the chain with the adjusting slide and clamp, so that the chain may be virtually shortened or lengthened to meet the temperature. 4th, The use of the spring catch, by means of which the balance and level is detached from the end link and attached to any other link in the chain at the pleasure of the operator. 5th, The method of attaching the thermometer to the end bar of the chain.

247. BUSTLES; Isaac W. Hakes, Jr., and A. H. Hakes, Norwich, Connecticut.

Claim—A "bustle," provided with front holding-straps and spring, when otherwise constructed.

248. COOLING AND FEEDING MATERIAL TO MILLS; B. Q. Harrington and U B. Burris, Missouri City, Missouri.

Claim—1st, The spiral chambers, for the purpose of creating currents of air for keeping the stones cool. 2d, The combination of the spiral buckets with the spiral chambers, when both are arranged in the manner set forth.

249. CHAIRS FOR RAILROADS; Alex. L. Holley, City of New York.

Claim—The combination of the splice and the bracket (the said splice and bracket being either the same piece or separate pieces), with the foot of the rail acting as a tension piece, or with a separate tension piece, in the manner described.

250. VARIABLE CUT-OFF GEAR FOR STEAM ENGINES; Alex. L. Holley, City of New York.

I disclaim the method described of moving the supplementary valve, the same being in use. I disclaim the use of a supplementary steam piston as the sole mover of a valve.

Claim—Such a combination of the motion of an eccentric, or its equivalent, with the motion of a steam piston for moving a valve, as will effect a variable cut-off of the induction steam, without interfering with a free exhaust, substantially in the manner described.

251. VARIABLE CUT-OFF GEAR FOR STEAM ENGINES; Bennet Hotchkiss, New Haven, Connecticut.

Claim—The combination of the sliding bar with the sliding collar, when constructed, arranged, and made to control the time of the cut-off by the operation of the governor or regulator only.

252. CORN SHELLERS; Wm. H. Hovey, Springfield, Massachusetts.

Claim—The arrangement and combination of the endless elevator, the spout, the spring presser, and the shelling cylinder. Also, the arrangement and combination of the grated trough with the elevator and the mechanism for removing the kernels from the cobs, and separating both kernels and cobs, such mechanism consisting mainly of the presser, the shelling cylinder, and the grid or bar. Also, the combination and arrangement of the guide hopper or receiver with the shelling mechanism, the grated trough, and the elevator, in the manner specified.

253. CORN SHELLERS; James J. Johnston, Alleghany, Pennsylvania.

Claim—The combination and arrangement of the discs or shelling wheels with the guard, guide, and spring or press-plate, constructed in the manner specified.

254. COMBINED STUMP EXTRACTOR AND PRESS; George Kenny, Milford, New Hampshire.

Claim—1st, The combination of the main frame, anchor frame, canting frame, with the shaft and the devices for working it. 2d, The main frame and windlass device, in combination with the removable pressing frame and box, as set forth.

255. APPARATUS FOR DRYING SHOE-PEGS AND GRAIN; Samuel Kimball and Wm. Sawyer, Boxford, Mass.

Claim—The arrangement of the steam pipes with the main cylinder, covered with wire gauze or perforated sheet metal, in whatever manner the steam may be introduced into said pipes, in combination with the floats, constructed and operating in the manner set forth. Also, the arrangement of the steam pipes with the main cylinder, covered with wire gauze or perforated sheet metal, without the floats, constructed and operating in the manner set forth.

256. PUMPS; A. C Laning, Wilkesbarre, Pennsylvania.

Claim—The stationary pipe or tube, valve chamber, and reciprocating cylinder, combined and arranged as set forth.

257. BRICK MACHINES; David Locke, Lexington, Missouri.

Claim—The elevated layer of tempered clay, arranged in connexion with the traveling plates or cutters and pressure plates, to operate as set forth.

258. SHINGLE MACHINE; H. H. Low, Galena, Illinois.

Claim—Operating the vertically reciprocating and balance frame from the saw or power shaft, through the medium of the pulleys and gearing, arranged with the slide bar, arm, and the springs and spring stop, as set forth.

259. COB AND GRAIN MILL; John R. Marston, City of New York.

Claim—The set bolt with its nut, or its equivalent, the slot in the shell of the cob-cutter, and the collar on the shaft, for the more practicable and reliable mode of retaining the cutters of the cob mill in their proper places.

260. EGG-BEATER; James F. Monroe, Fitchburgh, Massachusetts, and E. P. Monroe, City of New York, Assignors to E. P. Monroe, aforesaid.

Claim—The two beaters, constructed of wires and arranged in the adjustable frame, in such a manner that the same, by means of pinions, and by the bevel wheel, receive a rapid rotary motion in opposite directions.

261. IRON CARRIAGE WHEEL; John D. Murphy, Baltimore, Maryland.

Claim—A combined wrought and cast iron wheel, when the several parts composing said wheel are constructed in the form, and arranged and combined in the order, as described. Also, having the entire rim of the tread of the wheel open at one place, as shown at d', until after the hub is cast, in combination with the mode of inserting and fastening the spokes in the rim or tread of the wheel.

262. SKATES; Isaac W. and Frederick M. Norcross, Lowell, Massachusetts.

Claim—An improved mode of arranging and applying the spring, each being a continuation of the runner, and to extend laterally and longitudinally with reference to, and to be fastened at, the toe and heel of the foot-stand, as specified.

263. APPLYING ELECTRICITY IN DENTAL OPERATION; Wm. G. Oliver, Buffalo, New York.

Claim—The employment in producing local anesthesia in dental operations, of an apparatus, in which only non-metallic conductors are brought into contact with the parts being operated upon, as set forth.

264. RAILROAD CAR COUPLINGS; George W. Parshall, Middlefield, New York.

Claim—The construction and combination of the head-piece, tongue, wheel, and pin, arranged and operating as described.

265. SNOW PLOUGHS FOR RAILROADS; Willard Rhoads, Baltimore, Maryland.

Claim—The projecting flanch, in combination with the vertical sides, in the construction of the railroad track clearers.

266. SASH CORD FASTENER; Joseph R. Payson, Covington, Kentucky.

Claim—The cylindrical ring, in combination with the opening, neck, and eye, as described.

267. WEIGHING SCALES; Samuel Pierce, Cambridgeport, Massachusetts.

Claim—The combination and arrangement of the two poise slides and the fulcrum block, in the manner specified.

268. FLUID MEASURER; James L. Perry, Mansfield, and Melzer Burt, Norton, Massachusetts.

Claim—The fluid measurer, constructed substantially in manner, and to operate with respect to a barrel or reservoir, as specified—that is to say, as made of a close vessel, induction and eduction faucets, and a tell-tale valve and valve openings, or equivalent, the valve serving to indicate when the case may be full of liquid, the induction faucet allowing the flowage and interruption thereof of liquid into the case, and the eduction faucets determining the amount of flowage out of the case.

269. MILLS FOR GRINDING, CRUSHING, &c.; Philander Perry, Troy, New York.

Claim—The specified arrangement for effecting the combination, in one machine, of the grinding mill, cob-crusher, corn sheller, and straw cutter.

270. MACHINES FOR MAKING DRAIN PIPES; Bradford S. Pierce, New Bedford, and Mason K. Pierce, Mansfield, Massachusetts.

Claim—The arrangement of the mixing apparatus, pressing and core-relieving devices above the platform for conveying the moulds, in the manner specified. Also, the arrangement of the core-socket upon the revolving disk to receive the core and the mould, with a provision for discharging the core through the platform.

271. JOURNAL BOXES; Wm. S. Pratt, Brooklyn, New York.

Claim—The rollers, D D, placed between the rollers, C C, in the position and for the purposes specified.

272. CAR COUPLINGS; H. Purlier, Jesse Harlan, and E. C. Cheek, Cincinnati, Ohio.

Claim—The employment of the tripping-pin, in combination with the latch-lever, arranged and operating as described.

273. HYDRANTS; Washburn Race and S. R. C. Mathews, Seneca Falls, New York.

Claim—The combination and arrangement of the parts, consisting of the cap, having within its socket the spring, or its equivalent, stem attachment, interior tube, conical valve, and closed seat, whereby the valve is kept in place by the force of the spring, and operated free from the external pressure of the water.

274. HARVESTING MACHINES; Samuel Ray and Moses R. Shalters, Alliance, Ohio.

Claim—1st, Attaching the finger bar to the machines by means of the plate, one end of which is pivoted to the machine, and the other end connected with the finger bar by joints, the above parts being in connexion with a jointed connecting rod to admit of the folding and turning of the finger bar. 2d, Placing the driver's seat on the springs fitted in the hollow standards.

275. FOLDING SEAT; T. Reeve and M. B. Swezey, Brooklyn, New York.

Claim—The seat, B, attached to the end piece of the pew or settee by the pin of the bar, and the slot in the end piece, and provided with the hinged back and support, arranged as set forth.

276. MACHINES FOR TEMPERING AND MOULDING PLASTIC MATERIALS; Silas C. Salisbury, City of New York.

Claim—The employment of a series of two or more cylinders and the intervening guard blocks, in combination with a cylinder of larger diameter provided with flanches on its ends, so that the periphery of the larger cylinder, with its flanches, and the opposing surfaces of the series of cylinders and guard blocks, shall constitute the walls of a channel in which the plastic material, on its passage to the die or mould, is worked, tempered, and pressed, as set forth. Also, giving to the surface of the cylinder a greater velocity than the surface of the large cylinder, for the purposes set forth. Also forcing the plastic material into the die, between the cutting edges, by the pressure of a coat or layer of plastic material, formed on and adhering to the periphery of the large cylinder.

277. REVOLVING FIRE ARMS; Jacob Rupertus, Philadelphia, Pennsylvania.

Claim—1st, The safety tube, constructed as specified. 2d, Producing the necessary movements of the safety tube, by means of a forked or toothed lever, spring, or its equivalent, and a tooth on the tumbler, the whole being applied and operating as described.

[A magazine is provided for percussion caps or pellets within the hammer of a fire arm. A feeding slide is applied to the hammer and its contained magazine, which is operated as the hammer falls, causing a cap or pellet to be delivered from the magazine in front of the face of the hammer, and so interposed between the hammer and nipple as to be exploded by being driven by the hammer in contact with the nipple or surface surrounding the vent. There is also a mode of applying and operating a piston to push forward the caps remaining in the magazine after every delivery made by the feeding slide, whereby the inventor is enabled to obtain the greatest length of magazine that the size of the hammer admits of. Half of this patent has been assigned to John Krider and J. T. Siner.]

278. ATTACHING THE RAILS OF CARRIAGE SEATS; Cornelius Scofield, Trumbull, Connecticut.

Claim—The arrangement of the arms, A, the ends of which form half round recesses, in combination with the arms, C, and thumb-screw, for the purpose of supporting the rail and securing the same to the seat, in the manner set forth.

279. STEAM VALVES; C. A. Schultz, City of New York.

Claim—The combined arrangement of the spiral springs and their inclosing columns with the plate, as described.

280. EXCAVATING MACHINES; Charles Schott and James C. Baldwin, Nashville, Tennessee.

Claim—The combination and arrangement of lever with its connexion with bucket, for loading and unloading, in the manner set forth.

281. TEA AND COFFEE POT; J. W. Sener, Fredericksburgh, Virginia.

Claim—The safety apparatus, consisting in the combination of the tube, and the cap, and valve, constructed as specified.

282. STOVES; S. B. Sexton, Baltimore, Maryland.

Claim—The covered fuel cylinder, in combination with the chambers, flues, and dampers, together with the rear casing, constituting a cold air chamber, the arrangement being as set forth.

283. TREATMENT OF INDIA RUBBER; Alexander Shannon, City of New York.

Claim—The method of treating caoutchouc so as to combine therewith cork, or its equivalent, substantially as set forth.

284. INSTRUMENT FOR ASCERTAINING THE DIRECTION OF SOUNDS IN A FOG, &c.; Benj. R. Smith, Philadelphia, Pa.

Claim—A reflector made of suitable material and of such a form or shape that it will collect all the rays or waves of sound entering it to a focus, when pointed towards the direction from whence sound comes, for the purpose of ascertaining the direction of the source of such sound, and conversely of throwing off from the reflector, in parallel lines, if need be, the sound of a bell or whistle, which may be placed at the focus of the said reflector, substantially as described.

285. COAL OIL RETORTS; Wm. Smith, Pittsburgh, Pennsylvania.

Claim—The making of the agitating arms hollow, and to communicate with the hollow shaft, for the purpose of cooling them by means of the current of air or water passing through the said shaft, substantially as set forth.

286. STOVES; Wm. H. Smith, Newport, Rhode Island.

Claim—The arrangement of the partitions, F F', in combination with the partitions, E, and the openings, for the purpose of forcing the hot air to circulate around and in front of the ash-box, as specified.

287. STOP-COCKS; Erastus Stebbins, Chicopee, Massachusetts.

Claim—The arrangement and combination of the collar, flexible washer, metallic washer, as described. Also, the chambered nut or valve having apertures, as set forth.

288. BRAKE-HEADS FOR RAILROAD CARS; Nathan P. Stephens, Keene, New Hampshire.

Claim—1st, Suspending the brake-heads to the ends of the transverse brake-bar by the journals and boxes. 2d, Forming cogs or protuberances on the peripheries of the journal sleeves, and interposing strips of rubber, between them and the ends of the grooves in the journal box cap, in which the said cogs or protuberances move, for causing a greater pressure to be extended on the lower than on the upper portions of the shoes, as described.

289. EXCAVATING MACHINES; George D. Stillson, Rochester, New York.

Claim—In combination with an endless belt of digging hoes, a presser-wheel, that acts independently of the weight of the machine, for driving them into the ground, as described.

290. GOVERNORS FOR SUGAR MILLS; Robert Stott, Baton Rouge, Louisiana.

Claim—In combination, the caps, the bolts, the plates, when actuated on by the employment of a weight, or its equivalent, through an eccentric movement, when arranged as set forth.

291. WRENCH; George C. Taft, Worcester, New York.

Claim—The rosette with a female screw, in combination with the stationary screw, traversing male screw, and sliding jaw, with its female screw, as set forth.

292. APPARATUS FOR DEEP SEA SOUNDING AND METHOD OF CONVEYING AND PAYING-OUT LINE FOR OTHER PURPOSES; Wm. P. Trowbridge, Washington City, D. C.

Claim—The mode of conveying and extending a line across or through a given space, by means of a weight or projectile, the line being compactly coiled within a tube or case, which is attached to the weight or projectile, and moves along with it, and is discharged from the case or holder as the weight or projectile advances, while one end of the line is retained at the starting point, as described. I do not limit my claim to the particular manner of coiling the line described, or to any one mode of giving motion to the same, which may be the force of gravity, the propelling power of a rocket or cannon, or other motive power.

293. WASHING MACHINE; Michael Van Debogert, Binghampton, New York.

Claim—1st, Subjecting the articles to be washed to the combined action of the fluted or roughened surfaces of the tube and cylinder, the two surfaces moving, in part, in opposite, and in part, in the same direction with each vibration of the cylinder. 2d, The arrangement of the means for gearing and ungearing the wheels, as recited, whereby I am enabled to give vibrating motion to both of the rubbing surfaces, as described.

294. RAILROAD CAR BRAKES; A. P. Tutton, Reading, Pennsylvania.

Claim—Connecting the two shoes between the wheels at each side of the track, by means of racks and a pinion, whereby the shoes, when brought in contact with the treads of the wheels, are made by the action of the wheels to move simultaneously in opposite directions, and bind or wedge between them the wheels to stop the same, as described.

295. GRATES FOR FURNACES; Richard Van Velthoven, Philadelphia, Pennsylvania.

Claim—The frames with the bars forming the hinged rear of a furnace grate, in combination with the releasing and retaining cam, operated by the rod and the bracket, with its projecting chain, arranged as set forth.

296. HARVESTERS; Jacob V. A. Wemple, Chicago, Illinois.

Claim—The guard rod to separate the falling grain from that which lies on the platform, which the rack is passing down, and lay hold thereof, and also to prevent the grain from falling on the rake, arranged substantially in the manner described.

297. Railroad Chairs; J. W. Wetmore, Erie, Pennsylvania.

Claim—Notching the caps of the adjacent ends of H or T rails as at f, and the adaptation of a chair to surround the ends or joint within the shoulders of the notches, the chair forming the bearing surfaces for its length, and its leaves being bent under the base of the rail, and resting on the tie, as set forth.

298. Machine for Combing Fibrous Materials; Cullen Whipple, Providence, Rhode Island.

Claim—1st, Arranging the series of gill combs with a hot chest, or its equivalent, in such manner that said combs can be alternately sheathed and protruded from between heated plates, in the manner described. 2d, The combination of the stationary heated chest with the movable jaw, the two so combined operating to hold the fibrous substance firmly while the front end is being combed. 3d, Arranging the series of fine screen combs with the heated chest, in the manner described. 4th, The arrangement and combination of the revolving cylinder for first combing the front end of the sliver, the series of fine screen combs for combing the back end of the sliver, and the nippers for drawing the sliver through the screen combs, and delivering it upon the apron, the whole combination as arranged operating to draw and comb the wool, or other fibrous material, in a straight line, and to deliver it in a position to be formed into a continuous sliver, as described.

299. Steam Boilers; Edward Whitely, Boston, Massachusetts.

Claim—The water tubes within the space surrounding the boiler, arranged in the manner set forth.

300. Machine for Splitting Fire-wood; W. L Williams, City of New York.

Claim—1st, The employment or use of the endless feeding chains, when arranged as shown, or in any suitable way, so as to have the usual rotating movement around their pulleys, and also the lateral movement, for the purpose specified. 2d, The endless feeding chains, in combination with the yielding rollers, for the purpose of permitting the lateral movement of the chains. 3d, The yielding pawls in connexion with the yielding rods, in shafts and spurs, arranged to permit of the yielding of the blocks of wood while being split, as described.

301. Double Seaming Machine; James Wilson, C. Green, and Wm. Wilson, Jr., Wilmington, Delaware.

Claim—The combination of the discs and the burring pulley, the bearing down pulleys, the double burring pulleys, and the finishing pulley, in the manner described.

302. Machine for Corrugating Sheet Metal; James Wilson, C. Green, and Wm. Wilson, Jr., Wilmington, Delaware.

Claim—The arrangement of the upper and lower heads and the forming rollers, together with the rollers which support the cylinders to be corrugated at the requisite angle, as described.

303. Variable Cut-off Gear for Steam Engines; D. A. Woodbury, Rochester, New York.

Claim—The arrangement of the rocker and its variable slide, and the inclined or toggle-like connecting rods, in combination with the eccentric, or its equivalent, and the arms on the valve shafts, as described.

304. Mode of Opening and Closing Farm Gates by Hand; Gilbert Yates, West Dresden, New York.

Claim—The combination of the lever or arms with the connecting arms, vibrating, connecting, and unlatching piece and cords, when arranged and combined with the gate and posts, as set forth.

305. Automatic Fan; George W. Zeigler, Tiffin, Ohio.

Claim—The combination of the levers, B B, supporting the bedstead with the escapement wheel, F, lever, E, pendulum, and fan, together with the parts connecting the same for operating the fan from the weight of the occupant of the bed.

306. Restoring Waste Vulcanized India Rubber; F. Baschnazel, Wenham, Assignor to the Beverly Rubber Co., Beverly, Massachusetts.

Claim—The process described—that is, boiling waste vulcanized rubber in water, after it has been reduced to a finely divided state, for the purpose of restoring the same to a plastic, gummy, or elastic state, fit to be used again in the manufacture of india rubber fabrics and substances.

307. Hydraulic Presses; Thomas Baxter, Assignor to Wm. H. Baxter, Petersburgh, Virginia.

Claim—Making the cylinders of hydraulic presses in a manner described.

308. Needle Wrappers; Richard Bennett, Redditch, England, Assignor to J. F. Milward, City of New York; patented in England, May 7, 1857.

Claim—The employment, in combination with the outer wrapper, of an inner wrapper, with an attached piece through which the needles are stuck, in the manner described. Also, the employment, in combination with such inner wrapper, of a loop secured to the outer wrapper, substantially as specified.

309. Holding Keys for Strap Connexions for Engines; Truman Cook, Assignor to A. T. Smith, Washington City, D. C.

Claim—The notches in the key, as shown, the hole in the gib, the notch at the side of the said hole, the bolt with its peculiarly formed head, and the combination and arrangement of these parts upon the principle and in the manner set forth.

310. Saw Jointer; Sherman McLean, Royalton, New York, Assignor to the American Trades Company, City of New York.

Claim—The arrangement and adjustment of the file in the tool or file carrier, so constructed that when the flat side of the long arm of the tool is pressed against the side of the saw blade, it will present the file exactly at right-angles to the angular edges of the teeth, and being passed along over them, will square and make uniform their edges, the saw blade being placed, when the instrument is in use, between the long and short arms of the saw-jointer, as described.

311. Mole Plough; H. W. Rowland and E. Forbes, Assignors to selves and Washington Witherow, Newport, Ohio.

Claim—Pivoting the carriage to the beam near its forward end, as represented, and in combination therewith, the curved coulter pivoted to the beam and friction rest, all arranged and operating in the manner set forth.

312. Chamber of Ordnance and other Fire Arms; John P. Schenkl, Worcester, Assignor to self and E. A. Dana, Boston, Massachusetts.

Claim—The combination of an intercepting rod or leader with the secondary barrel or auxiliary charge chamber, and a projectile adapted to the gun or piece of ordnance.

313. Thermostat for Steam Boilers; O. M. Stillman and S. Wilcox, Jr., Westerly, Rhode Island.

Claim—Regulating the flow of the products of combustion to the superheater by the difference in pressure between the superheated steam and that of saturated steam, in the manner described.

APRIL 26.

314. STOVES; R. W. Belson, Philadelphia, Pennsylvania.

Claim—The semi-circular heater turning upon the hollow axis near to one side of the heater, arranged and combined with the stove in the manner set forth. Also, combining said heater by means of collar, with the air chamber in rear of the fire-back.

315. STOVES; R. W. Belson, Philadelphia, Pennsylvania.

Claim—The arrangement of the air heater sliding over the oven top and connected with the air passage. Also, making the damper and its shaft hollow.

316. ANIMAL TRAPS; A. S. Blake, Waterbury, Connecticut.

Claim—A trap, having its spring attached below the jaws, and the spring brought within, or nearly within, the diameter of the jaws.

317. SCREW WRENCH; Albert D. Briggs, Springfield, Massachusetts.

Claim—The application of the sleeve to the nut and the handle, so as to not only be capable of turning with and rotating the nut, but of moving longitudinally on the handle and with the nut, in accordance with the movement of the movable jaw on the shank.

318. DISHES FOR WAXING THREAD; George A. Brigham, Marlborough, Massachusetts.

Claim—The combination of the guard, the dripper, and the guides, with the two wires, to be placed in the dish to hold the thread.

319. SUGAR MILLS; John S. Brown and A. C. Greenleaf, Indianapolis, Indiana.

Claim—The combination and arrangement of the rods, levers, and bearings, with the set-screws, when constructed and operated as set forth.

320. STEAM ENGINES; Wm. W. Burgoyne, Washington City, D. C.

Claim—1st, The employment of the following elements in combination, for the accomplishment of the described object, to wit: a water-jacket open to the atmosphere, enclosing the fire chamber, piston chamber, and smoke-stack, a steam evaporating plate forming the crown plate of the fire-box, a supply pump for jetting in the water upon the evaporating plate, and a piston, which is hung or arranged so as to reciprocate in the path of a circle or in a straight line when operated upon by the evaporating steam, and in its movement operate the driving shaft of an engine. 2d, The manner described of making steam between an intensely heated plate, piston, and the isolated or comparatively cool sides of the piston chamber.

321. MARINE GOVERNORS FOR STEAM ENGINES; James L. Cathcart, Georgetown, D. C.

Claim—Regulating the supply of steam to marine steam engines by means of a pendulum, arranged and operated substantially as described.

322. HARVESTING MACHINES; George and W. Chamberlain, Olean, New York.

Claim—The combination and arrangement of the gathering fingers and knives with the reel, arms, receiver, and dischargers.

323. DEVICES FOR STARTING RAILROAD CARS; David Cumming, Sorrel Horse, Pennsylvania.

Claim—1st, In combination with the ratchet wheels and the ratchet bars, arranged as described. 2d, So arranging the ratchet bars with the sliding frame, to which the power is applied, as that said bars will be capable of slight play, up and down, when in clutch with their wheels, and will run entirely out of contact with said wheels without the aid of other mechanism.

324. MODE OF CONNECTING AND SUPPORTING RAILROAD RAILS; M. O. Davidson, City of New York.

Claim—The use of a rail having its lower web cut away for about 15 inches at the ends, in combination with the use of a bridge rail splice, of a form suitable to receive and support securely the stem of the rail after its lower web has been cut away, and of a length of about 30 inches, or of the distance from centre to centre of crop ties at the ends of the rails.

325. COTTON PRESS; Thomas F. de Bruler, Rockport, Indiana.

Claim—The construction and arrangement of the eccentrically operated gear racks with the connecting rod or yoke. Also, the combination of the said devices with the plunger or follower. Also, the construction, and arrangement, and combination of the traversing pinion with the sliding carriage and driving lever or arms.

326. MODE OF CONNECTING STRUNG PEARL JEWELRY; Henry Dubosq, Philadelphia, Pennsylvania.

Claim—Connecting the mother-of-pearl or plates of other material used to form the foundation on which the pearls are strung.

327. LOW WATER ALARM FOR STEAM BOILERS; Selah Dustin, Detroit, Michigan.

Claim—In combination with a steam cylinder located inside of a steam boiler, and having two openings in it, a float and rod carrying or operating two valves in equilibrio, and having no packed joints, by which means I avoid all undue pressure and friction, and render the float more sensitive to any variation of the height of the water in the boiler, and thus obtain a more reliable indication or signal than by any of the heretofore-essayed plans.

328. BREECH-LOADING FIRE ARMS; Willard C. Ellis, Springfield, Massachusetts.

Claim—The cere, having the double action of firing the pistol and unlocking the hook. Also, the lever, in this or any other form substantially the same, in combination with the lugs on the hammer or with lugs on the sides of the pistol frame. Further, the cocking of the pistol by the act of breaking down the barrel, in the manner described.

329. METHOD OF ADJUSTING THE KNIVES OF ROTARY CUTTER HEADS FOR PLANING WOOD; Benaiah Fitts, Worcester, Massachusetts.

Claim—Placing the bolt, or its equivalent, under the knife, to operate or adjust the knives, as described.

330. ROTARY PUMPS; Truman Freeman, Jr., Providence, Rhode Island.

Claim—The combination of the pistons with the dogs, arranged for conjoint operation with the cam and pin, in the manner specified.

331. WASHING MACHINE; Lockwood Gail and John H. Gail, West Falls, New York.

Claim—The arrangement of the vertical post and lever with the rubber.

332. SPRINGS FOR RAILROAD CARS AND CARRIAGES; Perry G. Gardiner, City of New York.

Claim—The construction of a spring by confining the ends of the exterior blades in bearings in the ends or heads of a tension bar, without rivets, bolts, hinges, pins, or screws.

333. STEAM-SPADING MACHINES; J. W. Goodell, East Wallingford, Vermont.

Claim—1st, The wheels provided with spades in connexion with the clearers and the rotating plates. 2d, The attaching of the frame which contains the wheels to a traction engine by means of a universal joint, in connexion with the gearing and shaft, whereby the frame and the wheels are allowed to conform to the inequalities of the ground and the working parts driven direct from the engine.

334. SELF-ACTING APPARATUS FOR WORKING RAILWAY BRAKES; Edouard Guerin, Paris, France.

Claim—The forked piece, vertical lever, provided with balance weight, rod, and collar, when arranged as set forth. I reserve to myself the right of varying or changing the forms, dimensions, and proportions of accessories and matters employed.

335. SEEDING MACHINES; Stephen R. Hunter, Cortlandt, New York.

Claim—The seed-distributing cylinder with adjustable shell, in combination with two or more seed-boxes or rotary harrow.

336. STEERING WHEEL; David Knowlton, Camden, Maine.

Claim—The metal rim or circle provided with sockets for the wooden arms or spokes of the wheels.

337. LADIES' COLLAR AND CUFFS; William E. Lockwood, Philadelphia, Pennsylvania.

Claim—Embossed cuffs, collars, and other articles of wearing apparel, made of a fabric composed of paper and thin muslin, or its equivalent, pasted together as set forth.

338. WATER METER; Nathan B. Marsh, Cincinnati, Ohio.

Claim—1st, The combination of the two side or end measuring chambers, middle piece or stationary cylinders, independent reciprocating interior cylinders, having septums, adjusting rods, and valve box, with its valves and passages, the former actuated by the reciprocating interior cylinders, and the latter forming inlet and outlet communications with and from the measuring chambers. 2d, Supporting the reciprocating interior cylinders on projections formed by the extension inwards of the end flanches of the stationary cylinders, and packing said reciprocating cylinders by the gaskets, which make tight the joints of the stationary cylinders with the measuring chambers, said gaskets being cupped or bent internally.

339. MACHINE FOR CORRUGATING SHEET METAL; Richard Montgomery, City of New York.

Claim—The combination of the bevel wheel and bevel pinions with the sleeve, projections, and fork, with the corrugated rolls, and the device for raising and lowering the corrugated roll, whereby a sheet of metal, once entered between the rolls, can be worked back and forth, and gradually and evenly corrugated at one heat and by one attendant.

340. MODE OF CHILLING RIMS FOR LOCOMOTIVE WHEELS; Hiram W. Moore, Jersey City, New Jersey.

Claim—The hollow chilled rim, whose inner and outer rims are not only united at the sides or ends thereof, but also united throughout the annulus by means of bracs extending from one to the other, for the purpose of strengthening the tread of the wheel and preventing it from cracking or breaking in.

341. TREATMENT OF VULCANIZED RUBBER; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—The use of olive oil in compositions of gutta-percha and india rubber, in the manner described.

342. REEFING SAILS; Enoch E. Mulliner, Camden, New Jersey.

Claim—The combination of the divided sail, with reef pennants, roller clews, pulleys, and yard or boom, as described.

[This invention consists in the arrangement of the lower part of a square or fore-and-aft sail as a bonnet, in combination with a yard or boom, and with proper reef pennants attached to the sail in such a manner that the lower part or bonnet can be reefed or furled to the yard either with or without the upper part of the sail and while connected thereto, and when furled to the yard or boom, can be disconnected from the upper part of the sail to prevent chafing while the upper part remains spread. This improvement applied to the topsails of large ships accomplishes everything that is accomplished by the use of double topsails, while dispensing with the weight of the two extra yards required with such a rig.]

343. FASTENING SLATS ON SUGAR CANE BAGASSE CARRIERS, &c.; Charles Neames, New Orleans, Louisiana.

Claim—The arrangement and combination of the two jaws hinged together at L, by means of a hinge pin, as described.

344. RAILS FOR STREET RAILROADS; Samuel Nicolson, Boston, Massachusetts.

Claim—Making each bearer not only with a grooved upper surface, but with a projection or lip at bottom, for the purpose of producing uniformity of strength in the section of the rail and of entering a corresponding groove in the stringer, and supporting the rail and its spikes or bolts against lateral strains.

345. MANUFACTURE OF ELASTIC BELTING; S T. Parmalee, Edinburgh, Scotland.

Claim—Submitting the belting, while within the heating or vulcanizing chamber, to pressure between the smooth surfaces of an endless metallic band, and one of two revolving metallic cylinders round which the said band passes.

346. SHARPENING THE CALKS OF HORSE-SHOES; A. W. Payne, Morris, New York.

Claim—The rotary burrs or cutters, one or more, in connexion with the bearing plate or plates, placed within a suitable frame or stock, and arranged as set forth.

347. WATER-PROOF LEATHER HOSE; James Punderford, New Haven, Connecticut.

Claim—Riveted leather hose, made with a water-proof lining applied to its inner surface and extending between the joint or lapping where such rivets are inserted.

348. MACHINES FOR RAKING HAY; David Rambler, Union Deposit, Pennsylvania.

Claim—The adjustable side bars, provided with the rake-heads, J J, and teeth, in connexion with the rake-head or shaft, B, provided with teeth, and used with or without the dividers, to operate as set forth.

349. CORN HARVESTERS; Isaac Reamer and Henry Miller, Conrad's Store, Virginia.

Claim—1st, The combination with the vertically adjustable upper guides, of the vertically adjustable reel, for action together. 2d, The reel, constructed with tangentially set tie-bars or guides, in combination with a platform on which the stalks fall parallel with the line of travel. 3d, The combination with the frame,

A, knife, c2, of the under adjustable frame, A'. 4th, The manner of connecting the platform with the frame of the machine, for the purpose set forth. 5th, Providing the platform with a slide back extension board, in the manner set forth. 6th, The arrangement with oblique or diagonal set spring blade or cutter of a fixed obliquely set carrying wheel, in the manner set forth.

350. STOVE POLISH MIXER AND SCRAPER; John C. Reed, Providence, Rhode Island.

Claim—The combination of the receptacle, scraper, and mixer, when arranged as described.

351. MACHINE FOR LAYING HEMP AROUND WIRE IN MAKING ROPE; Jacob Rinek, Easton, Pennsylvania.

Claim—The revolving yoke, with its hollow spindle and one or more rollers, arranged on and turning in the yoke, when the said yoke and its appendages are combined with, and arranged in, respect to the two sets of bobbins containing the strands of hemp, the perforated guide plates, and tube, as set forth.

352. SPRING BED-BOTTOM; ISAAC A Sergeant, Springfield, Ohio.

Claim—1st, The arrangement of the stretcher frame and rails, secured and supported as described. 2d, The supporting legs or stays and racks, in the described combination with the frame. 3d, The described arrangement of straps and knobs.

353. MACHINE FOR ADDRESSING NEWSPAPERS, &c.; George Shuck, Madison, Indiana.

Claim—The combination with the hopper which contains the documents to be addressed, of the sliding gate provided with a heel or step, and operating to close the hopper discharge, and at intervals to open the same in such manner as to permit of a single document being deposited from the pile in the hopper in front of said heel for after traverse with the gate. Also, the combination of the inclined feeding channel, main type channel, and raised discharge channel. Further, in connexion with the feed bolt, the angle lever, or its equivalent, to aid the type in its course from the feed channel to the main channel of the machine. Likewise, the employment of form boxes, for use as described, at either end of the machine. Also, the combination with the traversing type or form of a notice bell, or its equivalent, for operation by the type at intervals. Likewise, the combination with the bolster, operating essentially as described, of the springs for relieving the type from the paper, and holding it on the bolster and type-shifter. And, lastly, the document-discharging fly, when operated by the sliding gate.

354. COTTON SCRAPERS; Patrick Sharkey, Brownsville, Mississippi.

Claim—1st, Arranging the scrapers, one forward of the other, on guide blocks or runners of different lengths. 2d, The arrangement of a sleigh-runner shaped gauge with the short scraper.

355. SEWING MACHINES; Thomas Shaw, Philadelphia, Pennsylvania.

I do not claim, broadly, a needle-bar, to which a vertical as well as a horizontal motion is imparted by cams, or their equivalents—but I

Claim—The feed-bar, attached to and carried solely by the spring, operated vertically by the combined action of the rods and the aforesaid spring, and horizontally by the combined action of the independently adjustable screws and the same spring, and regulated by the screw on the stationary bracket.

356. GOVERNOR FOR REGULATING THE SPEED OF STEAM ENGINES; Thomas Silver, Philadelphia, Pennsylvania; patented in England, May 23, 1857.

Claim—The combination of a spring with a momentum wheel and adjustable speed-limiting vanes, the whole constructed with the combination of the peculiarly adjusted sectors, pinion, and links, as described.

357. DETECTIVE REGISTER FOR DOORS OF RAILROAD CARS; Walter C. Smith, Georgetown, D. C.

Claim—The opening and closing of car doors by means of the latch or key, in combination with the two index or registering wheels.

358. GAS PIPE CUTTER; Joseph E. Stanwood, Malden, Massachusetts.

Claim—My pipe or round rod cutter, as provided with a rotary cutting wheel to operate in conjunction with the claw or pipe-rest. Also, the arrangement of the cutting wheel carrier in a recess formed in the claw block, in combination with the arrangement of the adjustable screws and handle rod, with respect to the said recess and cutter wheel carrier.

359. SPRING CAR COUPLINGS; Frank Steinhart, Dansville, New York.

Claim—1st, The combination of the radial fenders, or their equivalent, with the jaws of the nippers. 2d, Constructing the bolt head with an open back, and also with a longitudinal recess in its back.

360. MACHINERY FOR ACCUMULATING AND TRANSMITTING POWER; Enos Stevens, Barnet, Vermont.

Claim—The endless chain forming the pendant loops, E and C, supported by the wheels, in combination with the weight suspended from a pulley supported by the loop, E, and the weight or guide pulley, and cord.

361. PUMP BOXES; Francis Stock and John Stock, San Jose, California.

Claim—The arrangement of the parts, j, k, l, of the box, in connexion with the bolts or rods and valve, as described.

362. STOP-COCKS; Thomas Stubblefield, Columbus, Georgia, Assignor to self and Peter Naylor, City of N. Y.

Claim—The combination of the lever, cap, valve stem, and spring, when the cap is provided with a semicircular opening into which fits the semicircular end of lever, for the purpose of forming a tight joint, without packing.

363. CARPET FASTENER; James A. Taylor, Cowlesville, New York.

Claim—The hooks and pins, arranged in combination with the carpet.

364. WRENCH; George C. Taft, Worcester, Massachusetts.

Claim—The screw-threaded rosette with its hole, in combination with the stationary guide rod, rack, traversing male screw, and sliding jaw, with its female screw.

365. GRINDING MILLS; George Todd, St. Louis, Missouri.

Claim—Securing the ears of the rim of the stationary stone between a double series of upper and lower springs, whose elasticity is governed and controlled by the series of adjusting screws.

366. PEN-HOLDERS; Alfred R. Turner, Malden, Massachusetts.

Claim—A pen-holder, constructed with the cover turning on a pivot or fulcrum, and acted upon by the bent spring. Also, in combination with the above, the sliding piece, as set forth.

367. LAMP WICKS; John B. Wortendyke, Godwinsville, New Jersey.

Claim—A lamp wick composed of strands that have received a preparatory twist in one direction, are then spun in the contrary direction with and coiled upon a thread, and are then twisted together.

368. Machines for Cutting and Folding Wadding and Paper; John Wood, Brooklyn, New York.

Claim—1st, The receiving box, provided with two compartments and fly-boards, connected with racks and with ratchets, actuated by the arms and cam, in connexion with the wheel and adjustable pinion. 2d, Operating the knife gate and plate, by means of the lever provided with the sector racks, which gear into the racks of gate and bar, so that the knife and plate will be actuated or made to perform their respective functions alternately. 3d, The arrangement of gearing, when used in connexion with the lever, for the purpose of operating the several parts automatically.

369. Refrigerator; Abraham Yost, City of New York.

Claim—The combination and arrangement of compartments, dampers, and escape tubes, as set forth.

370. Construction of Railroads; John Young, West Galway, New York.

Claim—Constructing a rail and saddle, whereby I am enabled to securely hold and render solid the joints or ends of rails during the passage of cars. Also, combining with said rail and saddle, the straining arch, key, and strip, for the purpose set forth.

371. Restoring Waste Rubber; Francis Baschnagel, Wenham, Assignor to the Beverly Rubber Co., Beverly, Massachusetts.

Claim—The process of restoring waste vulcanized rubber by reducing the same, by grinding or otherwise, to a finely divided state, and then submitting the same in a suitable vessel to the direct action of steam.

372. Sofa Bedstead; K. Borren, Assignor to Peter Schneider, City of New York.

Claim—1st, Constructing a sofa bedstead with an interior drawer, which may be pulled and united with the sofa seat, so as to form one bed or couch by the application of ways or grooves to the inside of the sofa frame. 2d, The horizontal rods of the sofa frame, in combination with the stay of the interior drawer, for the purpose of more securely guiding the said drawer. 3d, Providing the drawer with two back pins, in the manner and for the purpose described.

373. Steam Valves; Harry H. Evarts, Assignor to self and Phineas E. Merrihew, Chicago, Illinois.

Claim—The arrangement of the ports, cavities, and passages in the valves, in combination with a corresponding arrangement of the ports in the seat, whereby a single valve is made to perform its functions for the two cylinders of the engines, as set forth.

374. Hinge; Levi T. Howell, Burlington, New Jersey, Assignor to self and De Witt C. Taylor, Philadelphia, Pennsylvania.

Claim—The projection on one-half of the hinge, said projection being inclined on one side and abrupt on the other, in combination with the spring bolt and its notch, when the said bolt is so fitted to the other half of the hinge as to have a limited vertical, but no turning movement therein, and when the whole of the parts are arranged for joint action, as set forth.

375. Horse Power; Clark Lane, Assignor to Owens, Lane, Dyer & Co., Hamilton, Ohio.

Claim—The construction and adaptation of the stay rods with the hooked stand plates and racks on the sweep, or their equivalents, in combination.

376. Regulator for Time-keepers; Ralph S. Mershon, Assignor to self and John M. Harper, Philadelphia, Pennsylvania.

Claim—The application to watches, and such time-pieces as have their vibrations governed by a balance and hair spring, of a compound regulator composed of two or more movable segments, constructed and operating as described. Also, the combination of said compound regulator with a greater or lesser scale, the former fixed and the latter movable, but having a fixed indicator, and capable of being operated either in concert with, or independently of, each other, as described.

377. Seeding Machines; George W. Richardson, Grayville, Assignor to self and John P. Williams, White County, Illinois.

Claim—The arrangement of the cam wheel and lever with the seed slide and vibratory bar of the harrow, when the whole are constructed as set forth.

378. Joint for Gas and Water Pipes; James E. Quinn, Assignor to John M. Johnston, Chicago, Illinois.

Claim—The arrangement of the rings on pipe, in combination with the opening in the socket forming the cement chamber, for the purpose of joining pipes air and water-tight, by using cements in place of lead commonly used.

[The invention consists in providing a groove and shoulder at the junction of two sections of pipe or tubing for receiving and confining the cement. The cement is poured into this groove, and against the shoulder, from the outside of the pipe; and when the groove and the hole through which the cement is poured are filled, it is impossible almost to open the joint, and the cement is kept from exposure to the moisture. The use of lead solder is wholly dispensed with.]

379. Bed-bottom; Leonard B. Tinkham, Assignor to self and Charles Ryan, Lawrence, Massachusetts.

Claim—The combination of S-formed springs, arranged so as to receive the movable rivet and retain the slats in place, with bars and stirrups.

380. Egg-beater; John L. Nicolai, Assignor to self, S. E. Knott, and R. F. Farrell, Chicago, Illinois.

Claim—1st, The beaters, arranged with diverging fingers, which are attached to discs, to operate as set forth. 2d, The arrangement of a series of beaters on rotary shafts, so that the several beaters can be operated, as specified.

Extensions.

1. Wooden Bridges; George W. Thayer, Springfield, Massachusetts; patented April 22, 1845; extended April 26, 1859.

Claim—The combination of one or more series of iron screw rods with the suspension posts and cords or string pieces of a truss, in the manner specified. I do not claim the combining with the posts, braces, and strings of a truss, a series of supplementary braces. But I claim the arrangement of such a series of braces upon the outer sides of the truss, and so that they shall extend above and below the cords thereof, and be confined to the truss, as described.

2. Machines for Making Match Splints and Arranging them in the Dipping Frames; Asa Fessenden, Templeton, and Luke S. Knight, Barre, Mass.; patented April 26, 1845; extended April 26, 1859.

Claim—The combination with the series of cutters of the passages leading from the cutters, whether

there be one or more series of said cutters and passages. Also, the combination with the aforesaid cutters and passages of one or more dipping frames, arranged and operating with respect to them, as described. Also, the manner of making the dipping frames in sections of separate pieces or plates. Also, the combination of mechanism by which each of the blocks of wood is held down upon the carriage, and progressively forced forward against the board, the said mechanism being applied to the carriage and board. Also, the combination of machinery by which the dipping frames are progressively moved forward, the said machinery being connected with, and intervening between, the carriage and the said dipping frames.

Additional Improvements.

1. Seeding Machines; Charles Cox James, Dayton, Ohio; patented December 15, 1857; additional dated April 5, 1859.

Claim—The arrangement of the stationary roof-like screen, lateral sloping projections, septem, slides, slotted bars, and shoes, with slide and trough; constructed as described, and used in combination with the features covered by my patent of December 15, 1857.

2. Arithmometer for Addition; Orlando L. Castle, Upper Alton, Illinois; patented November 2, 1858; additional dated April 19, 1859.

I do not claim the use of any particular kind or arrangement of keys. But I

Claim—The combination of the rocker keys and shifting pawl, in any equivalent manner, and for the purposes set forth.

3. Machine for Dressing Mill-stones; Simon W. and R. M. Draper, South Dedham, Mass.; patented May 13, 1856; additional dated April 19, 1859.

Claim—The bed-piece with the cam, bar or lever, and rods, attached, provided with springs, in combination with the frame or carriage, with pick shaft attached, provided with the forked arm, arranged to operate as set forth.

4. Machine for Packing Wool; Charles Carlisle, Woodstock, Vermont; patented October 6, 1857; additional dated April 26, 1859.

Claim—Forming either or both of the leaves of two or more connected longitudinal sections, when the said jointed leaves are so arranged as to operate with the other parts of said machine, in the manner set forth.

5. Corn Shellers; Wm. Wells, Boston, Massachusetts; patented January 4, 1859; additional dated April 26, 1859.

Claim—The guide, in combination with the weighted or spring presser, made movable and adjustable with reference to the centre of the disc.

Re-Issues.

1. Making Illuminating Gas; N. Aubin, Albany, New York; patented January 8, 1856; re-issued April 5, 1859.

Claim—The described process of making gas for heating or illumination, which consists—1st, In mixing materials substantially such as are specified. 2d, In introducing them into a chamber, substantially such as described, located when the process is going on within retort. 3d, In causing the products of distillation of the mixture to pass out of such interior chamber, and then be subjected to a higher degree of heat by passing in contact with the heated surface of the retort itself, substantially as specified, not intending to claim any one step of the process separately, but only the process, substantially as set forth, as a whole.

2. Gas Generators; N. Aubin, Albany, New York; patented Jan. 8, 1856; re-issued April 5, 1859.

Claim—The combination with a gas retort of a removable interior chamber open at bottom, and having such relative shape with regard to the retort, and so located therein, substantially as is specified, and for the purposes set forth; and this I claim irrespective of the location of the opening through which said removable chamber can be introduced or withdrawn, and either with or without an apparatus for introducing steam into the retort.

3. Tight Joints for Gas Retorts; N. Aubin, Albany, New York; patented January 8, 1856; re-issued April 5, 1859.

Claim—A joint between a gas retort and its cover made by fusible metal contained in a groove into which enters a rim, the joint being such and for the purposes set forth.

4. Tubular Elastic Valve; Franklin Peale, Philadelphia, Pennsylvania; patented June 26, 1856; re-issued April 5, 1859.

Claim—1st, The flexible valves described, for the purposes specified. 2d, The method described of adapting the flexible valves to pumps, or other tubes of any kind, whether rigid or elastic, and inserting them therein, in the manner set forth, or in any equivalent mode.

5. Spring Bed-bottom; Hiram Tucker, Cambridgeport, Massachusetts; patented July 3, 1855; improvement added July 9, 1857; re-issued April 5, 1859.

Claim—The described spring bed-bottom, consisting of the combination of the frame, slats, and radial springs, as described.

6. Machinery for Making Wood Screws, &c.; Cullen Whipple, Providence, Rhode Island; Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—In combination with a mandrel which carries chuck or griping jaws, an automatic mechanism for closing said jaws upon the blank, keeping them closed to hold the blank while being dressed, and then opening them to release the dressed blank, arranged and operating in such manner as to leave the mandrel (during the time that the blank is being acted on by the cutter,) free from endwise pressure by the chucking mechanism. Also, in combination of toggle levers carried by the mandrel, a stop or hold-fast, also carried by the mandrel, to lock and hold the toggle levers when pushed beyond a straight line, and griping jaws with shanks having sufficient elasticity to maintain a firm hold of the jaws upon the blank, when the toggle levers have passed a straight line.

7. Machinery for Making Wood Screws, &c.; Cullen Whipple, Providence, Rhode Island, Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—A feeding punch and mechanism for causing it to approach within different distances of the griping

jaws adapted to receiving and holding screw blanks in variable positions and of different lengths, in combination with a suitable tool-holder and cutting tool.

8. MACHINERY FOR MAKING WOOD SCREWS, &c.; Cullen Whipple, Providence, Rhode Island, Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—The spring discharging punch, in combination with the mandrel and griping jaws, when the punch and spring are both carried by the mandrel.

9. MACHINERY FOR MAKING WOOD SCREWS, &c.; Cullen Whipple, Providence, Rhode Island, Assignor to the New England Screw Company; patented December 7, 1852; ante-dated June 7, 1852; re-issued April 12, 1859.

Claim—1st, The feeder composed of a sectional trough with a close bottom and open top, into which the blank drops and arranges itself before a traversing rod, which pushes it into the griping jaws. 2d, The combination of an adjustable automatic feeding punch and a spring-discharging punch, with an intermediate trough, or equivalent means for bringing the blank into line with two punches. 3d, The arrangement of a spring-discharging punch, with its end far enough within the end of the grooves in the griping jaws to leave an opening for admitting the end of a blank and guiding it against the end of the discharging-punch, thereby rendering the checking more certain.

10. PRINTING PRESSES; George P. Gordon, City of New York; patented July 13, 1858; re-issued April 12, 1859.

Claim—1st, The combination and arrangement of the feed-table, the fly or pile-board, the platen and bed, with the set or sets of independent revolving nippers or grippers, for the purposes described. 2d, The fly-board with its adjustable gauge or guide, in combination with the grippers or nippers to ensure the even piling of the sheets of paper, or their equivalents, whatever the size of the sheet may be. 3d, The vibrating double cam for throwing off and on the impression. 4th, Two or more distributing rollers, having a lateral motion upon a main distributor, which shall move independent of, and in opposite directions to, each other, and thus alternately cross and re-cross each other's distribution, for the purpose of giving a uniform inking to the form. Also, the two distributions given to the inking rollers upon one cylinder, for each impression (heretofore patented by me), in combination with the rotating reciprocating bed, with the spring extension attached.

11. AUTOMATIC GRIPPERS FOR CARRYING SHEETS OF PAPER IN PRINTING PRESSES; George P. Gordon, City of New York; patented July 13, 1858; re-issued April 12, 1859.

Claim—1st, One or more sets of grippers, nippers, or fingers to revolve independent in themselves upon an axis, for the purpose of carrying the sheets of paper to the place of impression, or for carrying the sheet, after it has received an impression, to its place of deposit upon the pile-board or fly-board, or for either or both of these purposes, thus receiving and piling the sheets of paper in an even and regular heap, by the acts of my automatic grippers or independent revolving nippers, or their equivalents. 2d, The combination of the independent revolving grippers with the vibrating feed-board, or its equivalent. 3d, The combination of the independent revolving grippers with a pile or fly-board, to be used as described, or in some equivalent way. 4th, The combination of the independent revolving grippers with a feed-board and a pile or fly-board, or their equivalents.

12. HARVESTERS; Thomas D. Burrall, Geneva, New York; patented March 18, 1856; re-issued April 12, 1859.

Claim—1st, The shoe-piece and racks to adjust the height of the outer end of the finger-board. 2d, The shaft, f, passing across the end of, and nearly at right angles to, the shaft, 1, of the main wheel, when fitted in such a manner that its pinion can be thrown into and out of gear with the face wheel.

13. COFFEE-ROASTERS; Theodore Heermans, Mitchelsville, Tennessee; patented January 18, 1859; re-issued April 12, 1859.

Claim—1st, The specified arrangement of the plates or shelves. 2d, The combination of a window or windows in a coffee-roaster, with agitating or elevating plates or shelves.

14. GRAIN AND GRASS HARVESTERS; E. B. Forbush, Buffalo, New York; patented July 20, 1852; re-issued July 8, 1856; re-re-issued April 19, 1859.

Claim—1st, The device for adjusting the cutting apparatus, which may be raised or lowered without changing the height of the main frame, in combination with the finger bar either with or without the removable platform. 2d, The combination of the inner projecting ends of the main frame with the adjustable cutting apparatus. 3d, Supporting the clamp and finger bar by means of the slotted iron frames and locking bolts, in combination with the cross-pieces of the main frame. 4th, The mould-board, constructed and arranged in the manner set forth. 5th, Extending or widening out the upper part of the guard finger by the overhanging bars, in combination with the central bar, in the manner specified. 6th, Arranging the three-pronged fingers, above described, so that they mutually brace each other in front of the finger bar, and are also braced and supported at each end of the cutter bar by the projections, in the manner specified. 7th, The raking apparatus, constructed and operating in the manner described. 8th, The movable fulcrum upon which the rake is suspended, and operated in the manner described.

15. GRAIN AND GRASS HARVESTERS; E. B. Forbush, Buffalo, New York; patented March 18, 1856; re-issued April 19, 1859.

Claim—1st, The manner of constructing and uniting the inner rear corner of the main frame, so as to depress or drop the shoe and cutting apparatus, and serve as a continuation of the shoe for treading down the stubble and mown grass, in the manner specified. 2d, The combination of the guide stirrup with the front of the main frame, so as to permit the draft-pole to play above and below the front of the main frame. 3d, Connecting the draft-pole to the machine by the oscillating pendent. 4th, So connecting the draft-pole to the machine, as that the draft shall be from the axle or centre line of the driving and supporting wheel, in connexion with the rear extension of the pole, in the manner specified. 5th, The combination of the extended finger bar with the adjusting shoe and adjustable hinged runner, as described. 6th, The combination of the main frame, draft-pole, guide stirrup, and adjustable shoe, arranged with each other in the manner specified. 7th, The adjusting shoe, constructed and operating in the manner set forth. 8th, The arrangement of the caster wheels with adjustable connecting bars in relation to the finger bar, platform, and frames of the machine, in the manner described.

16. WASHING MACHINE; H. E. Smith, Philadelphia, Pennsylvania; patented October 26, 1858; re-issued April 19, 1859.

Claim—1st, The vessel with its yielding valved diaphragm and the perforated diaphragm, or its equivalent, in combination with a pipe, o, communicating with the vessel at a point above, and the pipe, n, at a point

below the said diaphragm, and both pipes communicating with any suitable heating apparatus. 2d, The reciprocating plunger with its enlarged end constructed with the recess, flanch, and perforations, in combination with the yielding diaphragm, for the purposes specified. 3d, Providing the plunger with an upper enlargement concave on the under side, and arranged in respect to the lower plunger, substantially as set forth.

17. GRAIN HARVESTERS; Thomas D. Burrall, Geneva, New York; patented April 5, 1853; re-issued April 26, 1859.

Claim—The additional apron to convert the usual rear discharge into a side discharge of the cut grain. Also, the combination of the curved supports and the adjustable journal box piece to preserve the relative positions of the cogs in the mitre gearing, and at the same time allow of raising and depressing the driving wheel. Also, the notches in the back corners of each knife to prevent clogging or lodgment of fine grass in the cavities of the guards, said notches effecting a good purpose and not weakening the cutter.

18. GRAIN HARVESTERS; Thomas D. Burrall, Geneva, New York; patented April 5, 1853; re-issued April 26, 1859.

Claim—The location of the raker's seat with regard to the drive-wheel and platform. Also, in combination with a raker's seat, located as described, extending the rear of the platform far enough back to allow the raker from his seat to turn the grain upon the platform, and rake it off in an arc of a circle by a circular sweep or quarter turn movement of his rake.

19. ARRANGEMENT OF BUCKETS OF PADDLE-WHEELS; Mathew A. Crooker, City of New York; patented Oct. 28, 1856; re-issued April 26, 1859.

Claim—Arranging the floats or buckets of a paddle-wheel upon its arms, or the equivalent thereof, whereby the buckets shall be continuously increasing and diminishing their depth in the water as the said wheel revolves.

20. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—Driving the pegs into boots and shoes automatically, by means of a peg-driver operated up and down by a positive mechanical movement, whether impelled by a cam, eccentric, or crank, or other equivalent, substantially as specified.

21. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—The moving of the sole of the shoe along by means of the awl that forms the hole in which the peg is inserted, in combination with the peg-driver, whether the peg-driver be or be not employed to perform the additional function of presenting the peg, whereby each hole made by the awl is brought in succession in line for inserting the peg before the awl is withdrawn.

22. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—Cutting off shoe pegs from a strip of peg wood, or other material, by means of a lateral or side cut, that will cut straight across, when combined with suitable ways in which the strip slides, and machinery for driving the pegs. Also, inclosing the peg by the cutter until it is driven, as specified, by making the cutter, when in position, a part of the guiding tube. Also, the combination of the endless feed with a cutter for severing the pegs in a shoe-pegging machine, as specified.

23. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—Connecting the last with a horizontal slide or plate capable of presenting the shoe or boot, so that the shoe or boot attached thereto may be turned and moved in any direction, in a horizontal or inclined course, in combination with a mechanism which tends constantly to force it upward against a rest or guide, but which will permit it to yield downward, but this combination I claim only when combined with the pegging mechanism described, or any equivalent therefor. And I also claim as an automatic means of moving and guiding the last to present it to the pegging apparatus, in the required line of pegging, the guide groove, guide, and pinion, and curved neck, substantially as described, in combination with the mechanism above described, or the equivalent thereof, which permit the last to be moved in any desired direction, as set forth.

24. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—The combination of the universal movement carriage and lateral awl-movement, for properly presenting the shoe to receive the pegs in succession. Also, the combination of the mechanism for the cutting and feeding of the pegs, or any equivalent therefor, with the automatic peg-driver. Also, the combination of the following elements, or their mechanical equivalents, namely, the peg-former, the peg-feeder, the peg-driver, and the mechanism for moving the shoe, described, thus constituting an automatic machine for pegging shoes.

25. MACHINES FOR PEGGING BOOTS AND SHOES; John James Greenough, City of New York; patented Jan. 17, 1854; re-issued July 4, 1854; re-re-issued April 26, 1859.

Claim—The pegging of boots and shoes with nails or pegs of drawn wire. Also, driving the pegs by means of the cutting nippers, said nippers cutting off the peg after it is driven, substantially as specified.

26. TAILORS' SHEARS; Rochus Heinisch, Newark, New Jersey; patented July 13, 1858; re-issued April 26 1859.

Claim—The oblique rectilinear slot in the elongated shank of the lower blade, in combination with the fulcrum and a lever connecting with two portions of the shears behind the fulcrum.

27. MACHINE FOR MAKING PAPER BAGS AND ENVELOPES; North American Paper Bag and Envelope Manufacturing Co., Philadelphia, Pennsylvania, Assignees of J. A. Smith, Clinton, and S. E. Pettee, Roxborough, Massachusetts; patented May 1, 1855; re-issued April 26, 1859.

Claim—1st, The bar to relieve the end of the under sheet of the weights of the pile, partially or wholly. 2d, The friction bar to separate the under sheet. 3d, The guide bar in connexion with the bar. 4th, The lifter, to relieve the sheet from the weight of the pile. 5th, The feeding from the bottom of the pile. 6th, The combination of the weight bar, friction bar, guide bar, and lifter, constituting a feeding apparatus. 7th, The jaws to place the paper in position. 8th, In combination with machinery for making bags from paper of any size, we claim a former of the shape and dimensions required by the nature of the work to be done, over or around which the paper is to be folded, for the purpose of producing the bag or bags. 9th, The pasters and side folders. 10th, The combination of the table, the bar, the side folders, and pasters, all constructed as set forth.

28. SEWING MACHINES; Emeline M. Stedman, Vienna, New Jersey, Executrix of George W. Stedman, deceased; patented December 12, 1854; re-issued April 26, 1859.

Claim—1st, The tube described, receiving thread in the manner specified, and acting in combination with the needle, so that each forms a series of loops, each of which loops receives one and is received by the next one of the other series. 2d, The auxiliary plate carrying the guide for the looping tube, and secured to the bed-plate, so as to be adjustable to any desired position relatively with the needle. 3d, A reciprocating tube, or equivalent device, co-operating with an eye-pointed needle to concatenate or form the stitch, and produce sewing essentially as specified, combining with and receiving its motion from one end of a lever, the fulcrum of which is at or near the bed or table of the machine, while the other end carries the said needle. 4th, Feeding the cloth by means of a needle which is made to pass through the same in a position with respect to its length, diagonal to its line of movement, in combination with a spring to throw the needle into position to feed the cloth the next stitch, and the screw, or its equivalent, to determine and regulate the length of the stitch.

29. GRAIN AND GRASS HARVESTERS; Eliakim B. Forbush, Buffalo, New York; patented April 17, 1855; re-issued April 26, 1859.

Claim—1st, The arrangement and connexion of the rear cross-timber in relation to the main frame, in the manner specified. 2d, The peculiar construction and arrangement of the gear frame in relation to the main frame, driving wheel, and gearing. 3d, The gear key, in combination with the gearing shaft. 4th, The locks in the clamp. 5th, The track clearer, provided with the arms, arranged in relation to each other, and socket-piece, to operate in the manner described. 6th, A recess made in the outside shoe, in the rear of the outside cutter bar. 7th, The second angle at c r, formed by the brace bars of the guard finger.

DESIGNS.

1. FLOOR CLOTH; James Patterson, Elizabeth, New Jersey; dated April 5, 1859.

2. PLATES FOR COOKING STOVES; S. H. Ransom, Albany, New York; dated April 5, 1859.

3. PLATES FOR STOVES; S. H. Ransom, Albany, New York; dated April 5, 1859.

4. STOVES; Garrettson Smith and Henry Brown, Philadelphia, Pennsylvania, Assignors to Hayward, Bartlett & Co., Baltimore, Maryland; dated April 12, 1859.

5. STOVES; G. Smith and H. Brown, Assignors to North, Chase & North, Philadelphia, Pennsylvania; dated April 19, 1859.

6. COOK STOVES; Sherman S. Jewitt and Francis H. Root, Buffalo, New York; dated April 26, 1859.

7. TEA-POT, &c.; G. W. Smith, Hartford, Connecticut; dated April 26, 1859.

MAY 3.

1. MANUFACTURE OF WHITE LEAD; Fanning Albert, Brooklyn, New York.

Claim—The application of a rotating self-feeding cylinder for the drying of wet carbonate of lead.

2. ALARM WATER GAUGE; W. R. Andrews and John Oswald, Chicago, Illinois.

Claim—The disc valve, its stem and spring, applied in combination with the enclosing sockets, F and G, the latter of which contains an annular passage communicating with a whistle.

3. FAUCETS; Silas Barker, Hartford, Connecticut.

Claim—The vertical discharging orifice and the concave end cut-off to the face slide, in the manner set forth.

4. ELEVATORS; Albert Betteley, Boston, Massachusetts.

Claim—1st, The combination of the air reservoir with the movable car or platform of an elevator. 2d, Constructing the base of the car in the parachute form.

5. DOOR SPRING; Amos S. Blake, Waterbury, Connecticut.

Claim—The arrangement and combination of the spring, links, and arms.

6. MANUFACTURE OF WATCH CASES; James Boss, Philadelphia, Pennsylvania.

Claim—1st, Spinning-up of watch cases by the employment of a mandrel and spinning wheels, constructed in the manner set forth. 2d, Spun plated sheet metal watch cases, constructed as specified.

7. FASTENING FOR CURTAINS OF CARRIAGES, &c.; Wm. Z. W. Chapman, City of New York.

Claim—A curtain knob fastening, constructed so as to be readily opened from the base or on either side of the curtain.

8. SKATE FASTENING; Chandler Cheney, Milford, Massachusetts.

Claim—Securing the back part of the skate to the boot or shoe, by means of the spring band in connexion with the screws, or their equivalents, in the manner described.

9. SEWING MACHINES; D. W. Clark, Bridgeport, Connecticut.

Claim—As an improvement on my patent of August 31, 1858, the combination and arrangement of mechanism for the purpose of controlling the feed wheel, in the manner set forth.

10. WATER CASK LIFE-BOAT; Wm. N. Clark, Chester, Connecticut.

Claim—1st, Making the staves upon the lower side of the water cask more curved than those are upon the upper side, in order to give the life-boat a proper bearing and greater stability in the water. 2d, The ballast floor, water tank, and batch, when they are used in connexion with the water cask and life-boat.

11. SMOKE-STACK FOR LOCOMOTIVE ENGINE HOUSES; Henry Clayton, Tamaque, Pennsylvania.

Claim—The arrangement and combination with the smoke pipes of locomotive engines of a sliding tube, flue, and stack, as described.

[A series of flues communicate with a common stack at the centre of the building, the flues being provided each with a sliding or adjustable cap and tube, so arranged that each cap may be lowered over the top of a smoke pipe of a locomotive to convey the smoke therefrom into the stack, the tubes of the caps acting as valves as well as means of communication with the stack, so that when the caps are raised the flue of each elevated cap will be cut off below with the external air, and thereby prevented from injuring the draft of any of the flues in use.]

12. SKATE FASTENING; John H. Coe and Wm. B. Sniffen, Stratford, Connecticut.

Claim—1st, The employment of the curved adjustable slotted bars at the front of the foot or base plate, combined in relation to each other and secured together and to the said base or foot-plate, in position to correspond with the length of the foot and form of the front part of the same. 2d, The combination of the right and left screw and the clamps, with the heel part of the skate frame, so that both clamps are simultaneously moved. 3d, The combination of a hinged handle with the screw which operates the clamps, so that after the skate is fastened to the foot, the handle may be folded out of the way of the ice.

13. BOMB LANCE; Paschel B. Comins, San Francisco, California.

Claim—The employment of wings formed of a flexible material in connexion with metal springs, when so arranged as to be folded on the cylinder (for containing the powder), between the head and wad, in the manner set forth.

14. APPARATUS FOR GENERATING GAS; Mathias P. Coons, Brooklyn, New York.

Claim—The form and mode of arrangement of the retorts, as specified, for the purpose of combining a series of gas-generating retorts, as combined, for extending or diminishing its capacity of generating gas indefinitely. Also, the combination of a diaphragm surrounding a condensing chamber and escape pipe.

15. COOKING STOVES; Joseph Cox, Philadelphia, Pennsylvania.

Claim—The chamber above the top oven plate, communicating with the external air and fire chamber, whereby there is effected the double function of aiding combustion and equalizing the temperature of the upper portion of the oven.

16. VARIABLE CUT-OFF FOR STEAM ENGINES; Alexander Crumbie and Russell D. Briggs, Brooklyn, New York.

Claim—The arrangement and combination of the toggle rods, slide, rockers, stems, and lifters, as described.

17. TOBACCO PRESS; Edward and Wm. B. Cunningham, Powhatan Court House, Virginia.

Claim—Producing an improved hand press which is especially calculated to aid in compressing bunches of leaf tobacco into the proper shape for packing or "prizing;" the said press being composed of a narrow open box which has a fulcrum piece and a false bottom combined therewith, and a removable lever adapted thereto.

18. LAMPS; Michael A. Dietz, Brooklyn, New York.

Claim—Securing or connecting the deflector to and into the chimney band by means of a groove, as described.

19. LOCK FOR PIANO-FORTES; P. F. Dodge, West Cambridge, Massachusetts.

Claim—Actuating the bolt by means of the arm, of the tumbler, and the recess in the bolt.

20. PIANO-FORTES; Spencer B. Driggs, City of New York.

Claim—So arranging and applying the sound board and strings, and so constructing and applying the bridge or bridges of a piano-forte, that the depths of the bridge or bridges at the bearing points of the several strings, and the distances of the several strings from the board, are all in the same proportion, or thereabouts, to the length of string.

21. MACHINE FOR FILING GIN SAWS; James W. Elliott, Prattville, Alabama.

Claim—1st, Making said table adjustable at both ends. 2d, The standard, with the adjustable post and slotted bar for supporting the cylinder of saws. 3d, Making the way adjustable, both perpendicularly and laterally, for bringing the frame to any desired position. 4th, The use of the clamp screw, in combination with the way for holding the frame in position. 5th, A pawl held in place by the coiled spring and operated by the connecting rod, rock shaft, and levers or arms for rotating the saws. 6th, The friction plates for holding and moving the saws, said plates being arranged as described. 7th, The adjustability of the guides, for the purpose of pressing the files more or less against the saws, at pleasure.

22. FORMING CURVED ELECTROTYPE PLATES; Wm. H. Elliott, Plattsburg, New York.

Claim—1st, The employment of ledges, in combination with the form, for the purpose of holding a compound flexible impression sheet or type matrix in the required form, with or without screws. 2d, The employment of curved edges, in combination with the form, when said edges are so arranged in relation to said form that the edges of the compound impression sheet shall be held firmly between them, for the purpose of holding said impression sheet or type matrix in a cylindrical form. 3d, The employment of air escapes, in combination with form, box, and the flexible impression sheet, so as to provide for the escape of air from between the said impression sheet and form. 4th, The combination and arrangement of the concave form with the adjustable wires, for the purpose of holding the impression sheet in contact with the concave side of said form. 5th, The employment of a curved impression sheet of sufficient elasticity that it may be straightened out while the matrix is being formed by the type, and then spring up again by its own power to the form required, in combination with the curved form, when used for the construction of a curved type matrix.

23. SHINGLE MACHINE; Wm. Kirkpatrick, Lancaster, Pennsylvania.

Claim—1st, The added plate, constructed as described, and when acting in combination with the wrought iron piece and spring. 2d, The guide piece, as arranged and for the purpose specified. 3d, The combination of the rod with the pieces, g g and a a, by means of which the frow is enabled to accommodate itself to the winding grain of the timber.

24. HANDLE FOR CUTLERY; J. W. Gardner, Shelburne Falls, Massachusetts.

Claim—Attaching the handle to the knife, or other implements or tool, by means of a tang provided with a cylindrical projection and bolsters, the tang and projections being fitted in a longitudinal kerf or cut and hole in the handle, the bolster bearing on the end thereof, and the tang secured in the handle by a rivet.

25. MACHINE FOR CLEANING GRAIN; T. G. Gleason, Rochester, New York.

Claim—The arrangement of the screens, vibrating longitudinally with the fan, removable apron, and detachable smut cleaner.

26. VALVE GEAR FOR STEAM ENGINES; Thomas Hawkins, Mobile, Alabama.

Claim—The combination of the bearing and suspending plates, one on the toe and the other on the lifter, with a self-acting (or pendulum) catch for the purpose of holding open the steam valve to any desired point of the stroke.

27. WHEELWRIGHTS' MACHINE; T. L. Hawkins, Sturgeon, Missouri.

Claim—The arrangement of the several parts, as described.

28. LADIES' HOOP SKIRTS; John Holmes, Boston, Massachusetts.

Claim—1st, Constructing a skirt of "knotted" or "network," and this I claim whether the meshes on the front and back of the skirt are alike or not. 2d, Enlarging the rear upper portion of a skirt, formed by a series of meshes to form the bishop shape, by increasing the relative size or number of meshes on the rear upper portion thereof, as compared with those in the same course on the front of the skirt. 3d, The horizontal bustle-supporting spring, in combination with the compressed tape and the upper part of the skirt. 4th, The combination of the "netted skirt" with the hoops, spring, compressing tape, and waistband.

29. HAIR CRIMPER; Ellwood Ivins, Waterbury, Connecticut.

Claim—A hair crimp, composed of a fork and clasp, made as described.

30. EGG-BEATER; S. F. Jones, St. Paul, Indiana.

Claim—An egg-beater having a cup, shaft, strap, tube, slotted bar, cords, attached to shaft, and to adjusting screws in bar.

31. SKATES; Uriel Josephs, Quincy, Massachusetts.

Claim—1st, The combination of the braces or struts with the plates, either with or without the screw. 2d, The combination of the bar with the runner.

32. MEASURING FAUCETS; Ira Kinman, Freeport, Illinois.

Claim—1st, The employment of an endless screw, or its equivalent, in combination with the rotating slide and eccentric chamber. 2d, The register wheel and index hand, in combination with the stop, when the same is operated by the stem of the endless screw, so as to indicate the quantity of liquor drawn through the faucet.

33. WINDLASS; David Knowton, Camden, Maine.

Claim—The winch shaft provided with barrels and connected to the windlass by gears, and so arranged that the windlass may be worked by the winch shaft, or the winch shaft and barrels may be worked independent of the windlass.

34. STEAM BOILERS; L. Lefebre, Donaldsonville, Louisiana.

Claim—The longitudinally fluted boiler, braced as described, in combination with the conformable under surface of the exterior flue.

35. PUMPS; A. W. Lloyd, Otis, Massachusetts.

Claim—The arrangement and combination of the side tube, pipe, valve, and piston, as described.

[The invention consists in the use of a hollow piston, provided with a valve and fitted within a proper cylinder, an air-chamber being connected with the cylinder, and also a side water passage.]

36. GRINDING MILLS; J. C. Lyons, Auburn, and H. F. Philips, Seneca Falls, New York.

Claim—The described arrangement and combination of the grinding cone and the corn cracker, when the former is arranged on a shaft which receives a longitudinal motion by means of a hand wheel, and from which motion is conveyed to the corn cracker by means of wheels.

37. HARVESTING MACHINE; Henry Marcellus, Amsterdam, New York.

Claim—The corrugated finger bar cast with the cutting projections, in combination with the detachable fingers, constructed in the manner specified.

38. ROTARY ENGINE; Charles Miller, Belleville, Illinois.

Claim—All the parts specified, in combination, being and constituting a rotary steam engine, as asked for in my petition.

39. LOCOMOTIVE MACHINE FOR PROPELLING PLOUGHS, &c.; Wm. P. Miller, Marysville, California.

Claim—The combination of the endless chain or track with the leading and driving wheels and supporting trucks.

40. MODE OF ATTACHING HARNESS BREECHING TO WAGON THILLS; Aaron Parker, Coventry, New York.

Claim—The mode of attaching the hold-back straps to thills of vehicles, by having a metal ring to slide under a spring snap, in such manner that it will unfasten of itself when the traces are unhitched.

41. VULCANIZING CAOUTCHOUC; D. D. Parmelee, City of New York.

Claim—1st, The method described of treating caoutchouc, gutta-percha, and their compounds, by employing agents in an æriform or gaseous state, combined with a solvent in a liquid state. 2d, In combination with a solution prepared in the manner specified, to operate on caoutchouc, gutta-percha, or their compounds, preparing the said caoutchouc, gutta-percha, or their compounds, by blending or incorporating therewith sulphur. 3d, Dissolving sulphur in the proportions set forth, or thereabouts, in the solution, prepared as specified, when the same is used in combination with rubber, gutta-percha, or their compounds, previously free from sulphur.

42. CEMENTS; Nelson Parmeter, Gardner, Massachusetts.

Claim—An improved fire-proof cement, composed of said ingredients, in the proportions and in the manner set forth.

43. WRENCH FOR GAS FITTERS; G. P. Phillips, Albany, New York.

Claim—The jaw, arranged to slide, so as to wedge, gripe, or tighten and hold the article to be turned. Also, the nut, K, arranged to slide freely on the bar, and so that it may be locked to the bar, when desired, in combination with the bar. And in combination with the nut, the tightening nut, I, arranged as described.

44. ADJUSTABLE PILE-DRIVER; Thomas Place, Alfred Centre, New York.

Claim—1st, Attaching the frame to the axles by means of the bolt, and rack plate, and guides, to admit the lateral adjustment of the monkey guides. 2d, Screwing the monkey guides in the frame, by means of the universal joint and the sliding joint, arranged with the lever and rack catch, or their equivalents, to admit of the lateral inclining of the guides, as well as the forward and backward movement of the same. 3d, The combination of the frame and guides, when constructed and arranged to operate conjointly, and to admit of the adjustment, as described. 4th, The arrangement of the button or stop, levers, and catch, automatically releasing the shaft from the windlass.

45. LATCH HINGES; John Plant, Washington City, D. C.

Claim—The hinges, when provided with projections and latch, and when constructed as set forth.

46. COTTON PRESSES; H. W. Randle, Burnsville, Alabama.

Claim—The vertical screw shaft, as described, in combination with the levers, cords, and the follower.

47. Revolving Fire Arms; Joseph Rider, Newark, Ohio.

Claim—1st, The cocking-dog with its notches, applied in combination with the hammer and trigger, and with a stationary stop to effect the cocking of the hammer and firing. 2d, In combination with the above, providing the same cocking dog with a notch in its extremity to be operated upon by a tooth on the trigger, to operate the piece entirely by the trigger for rapidly repeated firing without cocking. 3d, Combining the locking lever with the cocking-dog, by means of a tooth upon the lever and a tooth upon the dog, the tooth being formed to operate as specified. 4th, The construction and application of the trigger guard, in combination with the locking levers, to serve three purposes, viz: as the guard, as the lever for operating the rammer, and as the spring for operating the locking lever, or its equivalent.

48. Cider Mills; Joseph Rosencrans, Avoca, New York.

Claim—The arrangement of the cutting cylinder and the tearing cylinder within the hopper, the one acting upon a plane and the other upon a curved surface, and the tearing cylinder so geared as to have rapid rotation as regards the rotation of the cutting cylinder. 2d, The arrangement of the grinding cylinders and pressing cylinders with the endless apron, chute, and hopper, when they are geared, as set forth.

49. Mail Bags; Washington Ruddach, Baltimore, Maryland.

Claim—The arrangement of the jointed plates, staples, jointed slide, with projection, when applied to bags with riveted and stitched seams.

50. Punching and Stamping Press; Stephen P. Ruggles, Boston, Massachusetts.

Claim—So combining in a press for punching, stamping, &c., a coarse and fine threaded screw, with the power that drives the press, as that the coarse screw may be in action when speed or motion is required, and the fine screw when power is required; the former ceasing its action and the latter coming into action according to the resistance against the punch or die.

51. Corn and Cob Cutter; Samuel B. Shinn, Philadelphia, Pennsylvania.

Claim—The peculiar construction of the cutter head, with or without the combination of the knives and crushers, arranged in the manner set forth.

52. Washing Machine; Olloff Shostrom, Altona, Illinois.

Claim—The combination and arrangement of slats, levers, serrated plates, with rods, false bottom, endless apron, lever, and pawl.

53. Coffee-roasters; Jonathan P. Simmons, Baldwinsville, New York.

Claim—The combination of the revolving ring with the spherical case, as specified.

54. Spinning Flyers; D. F. Smith, Manchester, New Hampshire.

Claim—The construction of the arm and stem of the compresser of one piece and the stop of a separated piece, so applied as to confine the stem in the ears on the flyer-tube.

55. Harvesting Machines; Joseph D. Smith, Lancaster, Ohio.

Claim—1st, The arrangement of the mechanism for adjusting the cutting apparatus, consisting of the rack bars, hinged to the cutting apparatus shaft provided with pinions, and ratchet wheel and pawl, when employed in combination with the adjustable wheel, in the manner specified. 2d, The employment of the ball journals of the reel shaft, in combination with the off-side horizontally turning timber of the reel frame. 3d, The combination of the secondary standard, arranged on the sickle bar with the hinged laterally adjustable brace, in the manner described. 4th, The combination with the upward curved edge of the sickle bar, of the overhanging upper lip and under back extension flanch of the sickle guard or tooth. 5th, The spring catch arranged on the sickle back, in combination with the stop-notch formed in the pitman, for the purpose of fastening the sickle or cutter-back to the pitman.

56. Rotary Planing Machines; Wm. H. Smith, Newport, Rhode Island.

Claim—The combination of the rotating cutter head with the central adjustable bearing plate, arranged as set forth.

57. Portable Horse Powers; George W. Swift, Oxford, Mississippi.

Claim—The arrangement of band wheel, shafts, idlers, roller, and cord or chain.

58. Machine for Cutting Wooden Curved Mouldings; Isaac P. Tice, Baltimore, Maryland.

Claim—The adjustable bed formed of the blocks in connexion with the flexible guide plate, rotary cutter head, and the feed or pressure rollers, or their equivalents.

59. Signals for Firemen; Hezekiah D. Treadwell, Elmira, New York.

Claim—The combination of the catch plates and conical stops, or their equivalents, on the cords, working through a series of holes in the catch plates.

60. Water Wheels; Wm. Walker, Pontiac, Michigan.

Claim—1st, The employment or use of the adjustable plates attached to the inner posts of the plates, *e*, of the buckets. 2d, Providing the buckets with adjustable plates to prevent injury to the buckets by the entrance into the scroll of hard foreign substances.

[This invention relates to an improvement in horizontal centre-discharge water wheels, and consists, first, in having the front or outer parts of the buckets made movable or adjustable in such a way that in case of stones, sticks, or foreign substances of any kind entering the scroll, the buckets will be allowed to yield or give, and be prevented from being broken. The invention consists, secondly, in the employment of a series of adjustable plates or stops, applied to the wheel in such a manner that the issues or discharge orifices between the buckets may be enlarged or contracted as circumstances may require.]

61. Lamp Shades; Charles and Anna C. Wilhelm, Philadelphia, Pennsylvania.

Claim—The combination of the metallic shade with the paper pictures between the sheets of mica.

62. Metallic Lathe; Wm. E. Worthen, City of New York.

Claim—A corrugated pierced sheet of metal, substantially such as specified, either with or without rods or tubes passed through the apertures.

63. Harvesting Machines; W. A. Wood, Hoosick Falls, New York.

Claim—Effecting an oblique delivery of the cut grain from the platform where it falls, by a series of carrying belts of different lengths.

64. Machine for Making Pearl Barley; August Wulze, St. Louis, Missouri.

Claim—The arrangement and combination of the frame or wheel, H, pinions, t and u, and wheel, I, with each other and with the pulleys, as set forth.

65. AIR ENGINE; Stephen Wilcox, Jr., Westerly, Rhode Island.

Claim—1st, The arrangement of the changing cylinder, B, and working cylinder, D, and the valve or valves by which piston, b, is made both to change the air from the cold to the hot end of the cylinder, and to receive a fresh volume of air from the next stroke, with the advantages set forth. 2d, Automatically regulating the temperature of the interior of the heating surfaces by the employment of the parts, H and L, arranged relatively to the heating surfaces of the cylinders, A and B, and to the damper, or its equivalent, in the flue. 3d, Giving the regenerator an increasing area from the cold to the hot side. 4th, Working the single valve, in combination with the two pistons, a and b, as described, so as to thereby accomplish the threefold purpose of induction, eduction, and equilibrium valve.

66. AMALGAMATOR; F. B. Cavanah, Assignor to self and R. H. Northrop, Pioneer Mills, North Carolina, and W. A. McCulloch and E. C. Aiken, Albany, New York.

Claim—The arrangement and combination of the elevated quicksilver channels near the rim of the oscillating amalgamating pan.

[This machine is more particularly intended for the washing and amalgamation of gold found in quartz rock, but also applicable to the extraction, by washing and amalgamation, of gold and other metals from various foreign substances with which they may be found incorporated in nature. It consists of a circular pan containing a peculiarly constructed series of concentric channels, arranged to oscillate about a vertical axis, and furnished with a central funnel and distributing cone to cause the pulverized metalliferous matter from which the gold or other metal is to be extracted, to be fed with a suitable amount of water all round the outermost channel, from whence it has to make its way from one to another of the several channels over and among quicksilver, which is contained in certain or all of the channels, to a discharging pipe or orifice at or near the centre of the vessel.]

67. CEMENTS FOR ROOFING; Nathan A. Dyar, Medford, Assignor to self and Rufus Kendrick, Cambridgeport, Massachusetts.

Claim—A central layer or web of cloth, or its equivalent, covered on both sides with adhering layers of water-proofing, the outward side of one of which is covered with a layer of paper fixed thereto by contact with the water-proofing while it is in a warm and plastic state, while upon, and embedded in, the outward side of the other layer of water-proofing, while in the state just described, is a layer of sand, or its equivalent, forming the uppermost or weather surface of the article.

68. MECHANISM FOR OPERATING STEAM OR AIR SIGNAL WHISTLES; Moses G. Farmer, Salem, Assignor to Wm. F. Channing, Boston, Massachusetts.

Claim—The combination of an electro-magnetic escapement with the mechanism described for operating a steam or air whistle.

69. REED ORGANS; Theophile Auguste Rousseau, Belleville (near Paris), Assignor to Edouard Alexandre, Paris, France; patented in France, January 23, 1857.

Claim—1st, The arrangement of the wind chambers and registers or stops, in combination with the reeds, whereby each key operates as many valves as there are stops in the instrument, but only those notes are caused to sound where the register is open, thus rendering the fingering easy whatever may be the number of stops. 2d, The arrangement of the valves and knee-pieces, in the manner specified. 3d, The manner specified of arranging the various plans or stories of the instrument, and hinging the same together for affording access to the different parts.

70. VALVES FOR STEAM ENGINES; Wm. Shepherd, Jr., Assignor to Thomas Holmes and Van Wyck Foster, Brooklyn, Eastern District, New York.

I do not claim the prevention of the slamming of the valve, without reference to the means by which such result is accomplished; neither do I claim, broadly, the interposition of a steam cushion to check the motion of the valve. But I

Claim—The combination of the steam ports with the cover operated by the action of the valve, substantially as described.

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71. CULTIVATORS; Milton Alden, Auburn, New York.

Claim—The described arrangement and combination of the adjustable shares, the frame, and the raised thills, which are made out of one piece with the handles.

72. MACHINE FOR SAWING SHINGLES; Wm. H. Auld, Brighton, Iowa.

Claim—The adjustable saws in connexion with the reciprocating bolt carriage. Also, the arrangement of the notched racks, gearing, weight, pins, levers, and bars, attached to the bolt carriage, in connexion with the stops for automatically feeding the bolt to the saws.

73. MACHINES FOR SEPARATING STONES, &c., FROM CLAY; Charles Bamberg and Roman Blaser, Chicago, Ill.

Claim—The conical rotating screen, in connexion with the separator placed within suitable boxes.

[A conical screen of knives is connected with a separator, and placed in a suitable box provided with discharge spouts, and this forms the invention, the object of which is to separate large gravel, stones, and all coarse foreign substances from clay preparatory to its manufacture into bricks, pottery, &c.]

74. SOLE-CUTTING MACHINES; Jacob Batchelder, Salem, Massachusetts.

Claim—1st, The particular and relative arrangement of the levers with the cranks for giving the required motions to the cutting knives. 2d, The use and arrangement of the adjustable and intermediate gauge board, whereby each alternate sole can be cut of equal or unequel width.

75. STRAW CUTTERS; John Bean and Benjamin Wright, Hudson, Michigan.

Claim—The arrangement and combination of the knife, lever, and rock shaft.

76. RAILROADS FOR STREETS; S. A. Beers, Brooklyn, New York.

Claim—The construction of upright self-sustaining rails of cast or other iron, with car and carriage track combined, to be laid in public streets and highways, and for no other purpose.

77. BRICK MACHINES; H. T. Beggs, Liberty, and James Allen, Lynchburg, Virginia.

Claim—The combination of the bevel wheel cast with the cells therein, for the reception of the moulds, the plungers, with the friction rollers and axles, circular inclined plane ring, guard, and top plate.

78. SKATE FASTENING; Edward Behr, City of New York.

Claim—Drawing or tightening the toe and heel straps of the skate around the foot of the wearer, by means of the screw rods and nuts fitted in the stock, one end of the straps being attached to the stock, and the opposite end to the nuts by means of the cords, or their equivalents.

79. SHIPS' STOP BLOCKS; A. J. Bentley and Wm. H. Allen, City of New York.

Claim—The arrangement of rollers and wedges.

[In this block the rope runs between wedges provided with rollers, and the moment the wedges are released, they are pressed together by two helical springs, and the more the rope is pulled, the faster it is held between the edges.]

80. CORN PLANTERS; L. F. Bingham and N. O. Pierce, Chicago, Illinois.

Claim—The arrangement of the rotating planter, square tube, beam, lever, "spat down" or leveler, and scraper.

81. CORN PLANTERS; A. W. Brinkerhoff, Upper Sandusky, Ohio.

Claim—The adjustable coverer and opener, in combination with lever, L, the weighted lever, A, operating the rollers and rod.

82. MANUFACTURE OF PAPER AND PAPER PULP; James Brown, London, England; patented in England, June 10, 1857.

Claim—The treatment of paper and paper material with glycerine, to be employed for printing or other purposes.

83. PLOUGHS; C. M. Bryan, Wright City, Missouri.

Claim—Attaching the mould-board by means of the bolts passing through cleets at the inner side of the mould-board, and into the landside and handle, the bolts and the brace bar.

84. MACHINES FOR LOADING HAY; S. V. Essick, Moultrie, Ohio.

Claim—The adjustable frame, the rake, the rakers, and the conveyors.

85. MACHINES FOR SEWING FERTILIZERS; T. J. Burrall, Geneva, New York.

Claim—The arrangement of the revolving cylinder, divisions, and adjustable perforated slides.

86. MACHINES FOR SPLITTING LEATHER; D. H. Chamberlain, West Roxbury, Massachusetts.

Claim—Inclosing the cutting blade within an external casing throughout its entire length.

87. CONVERTIBLE CARRIAGE SHAFTS; R. J. Colvin, Lancaster, Pennsylvania.

Claim—1st, The attachment of removable shafts by means of adjustable braces and the hinged caps of the pole crab. 2d, The curved or segment bars forming a transverse horizontal slot in which the shafts are supported at their rear end, both when separated in the ordinary way, and when united together as a pole. 3d, The hinged and pivoted thill attachment for accommodating the width of the same to the different positions of the clips upon the axle.

88. BUTTERFLY VALVES; Nathan Cope and Wm. Hodgson, Cincinnati, Ohio.

Claim—The arrangement and combination of the curved slotted plate, valve-box, stops, and slotted valve lever.

89. GRAIN SEPARATORS; J. B. Crist, Evansville, Indiana.

Claim—The arrangement of the blast passage, fan, screen, and riddle, with chute attached, placed within the case or box, and in relation with the spouts or discharge passages.

90. PLOUGHS; E. Davidson, Batesville, Arkansas.

Claim—The combination of the bar, stirrup, rod, with the adjustable supplemental landside, F, share, C, and the stationary share, E, and landside, C.

91. FENCE POST; H. T. Dewey, Sandusky, Ohio.

Claim—The combination of the ribbed post and horizontal flanch plate, when jointed to each other.

92. CULTIVATORS; Wm. C. Doss, Lavacca, Texas.

Claim—The arrangement of the triangular frame of shares, with mould-boards that may be taken off at pleasure, scraper, and cultivators.

93. FURNACES FOR HEATING BUILDINGS; B. W. Dunklee, Boston, Massachusetts.

Claim—Combining with the fire-pot and its dome one or more gas-circulating pipes, arranged with respect to the same, and in the hot air chamber of the case. Also, the arrangement of the hot air discharge pipes, and the wings of the arch of the fire dome. Also, in connexion with air register to the front of the ash-pit, an air pipe, carried through the air chamber and into the rear part of the ash-pit. Also, the combination and arrangement of the hoe valve and the plate or door with the flue, the pipe, and the opening.

94. METHOD OF COMPENSATING FOR EXPANSION AND CONTRACTION OF METALLIC FENCES; Lewis Eikenberry, Easton, Pennsylvania.

Claim—The method of making provision for expansion and contraction in an iron lattice or other open work fence.

95. STRAW CUTTERS; Stephen Elliott, Richmond, Indiana.

Claim—The arrangement of boards, E, cross-piece, rods, J and G, and lever, H, with boards, B and D, canvas, C, rods, R and S, and lever, Q.

96. SMOOTHING IRON; Andrew Ellison, Boston, Massachusetts.

Claim—Attaching the handle plate to the separate heater or block, by means of the guide and slot, the angular recess and lips, and the latching devices.

97. METHOD OF STRAPPING WOOD IN BENDING; John L. Field, Syracuse, New York.

Claim—The method for connecting metallic straps for bending timber, when the parts are so arranged as to operate in connexion with the forming frames.

98. SEED PLANTERS; D. S. Fisher, Mauckport, Indiana.

Claim—The combination and arrangement of the spring hoe, adjustable spring roller, with the seeding and regulating apparatus.

99. HARROWS; J. H. French, Syracuse, New York.

Claim—1st, The combination and arrangement of three triangular harrows, in such manner as to form

one triple triangular harrow, by connecting the angles with flexible joints or couplings, which admit of the free vibration of the parts, and their ready adaptation to the inequalities of the ground. 2d, Constructing triangular harrows of metallic bars or flat strips of metal, by folding over the same at the angles, in such a manner that the draft strain of the teeth upon one side, shall counteract that upon the other, and forming the couplings at the same operation, by folding in links or hooks at the angles, no bolts being required to secure them in consequence of the self-bracing of the parts.

100. CORN PLANTERS; R. B. Gilbert, Sutherland Springs, Texas.

Claim—The arrangement of the share, coverers, conductor, cylinder, and hopper, wheel, and scraper, for joint operation.

101. MAIL BAGS; Richard Gornall, Baltimore, Maryland.

Claim—The employment with a mail bag, constructed with a socket and furnished with a lock or other safe fastening of the plates, which terminate in nearly complete tubes, and with the jointed rod or bolt, provided with a hasp or other similar attachment.

102. RAT TRAPS; Henry Gortner, Irville, Ohio.

Claim—The rotating discs connected by the plates, b b, in connexion with the treadle platform, plates, c c, and bar, d, and the supplemental platform, the whole being fitted to the box.

103. MECHANISM BY WHICH EMPLOYEES REGISTER THEIR TIME; Benjamin T. Harris, Brooklyn, New York.

Claim—1st, The manner of mounting the cylinder on the spring barrel, and with the connecting coupling. 2d, The binding plate, fitted and acting to retain the ends of the paper to the cylinder. 3d, The arrangement and manner of constructing the slides and impression point. 4th, The rollers and their pawls, in connexion with the slides and openings in the front plate.

104. CORN PLANTERS; Samuel E. Hartwell, City of New York.

Claim—The arrangement of the slide, shoe, and hoe, connecting and acting in the manner as specified.

105. SEEDING MACHINES; Samuel Henry, Chenoa, Illinois.

Claim—The slide bar or seed-distributor, with slide fitted therein and placed relatively with the seed-box.

106. HARVESTING MACHINE; Moses G. Hubbard, Penn Yan, New York.

Claim—The conformation of the intermediate fingers of a reaping and mowing machine, having a conical form with a straight outline from point to heel, so as to present a straight gradual taper on the underside as well as above. Also, the safety flanch for securing the pitman connexion.

107. MACHINES FOR BREAKING COAL; Charles W. Kennedy and Richard T. Brown, Williamsburg, New York.

Claim—The arrangement and combination of the polygonal spiked drum, spiked crushing plate, and spiked clearing plate.

108. RAILROAD CAR BRAKES; Lewis Kirk, Reading, Pennsylvania.

Claim—1st, The arrangement of the hand-wheel and the rod, in combination with the pump, so that by depressing the rod the pump is placed in working order, and that the same can be operated by means of the hand wheel. 2d, The arrangement of the spring catch which is attached to the piston rod of one of the pump cylinders, in combination with the bell crank, or its equivalent, which is operated by means of an eccentric. 3d, Arranging the coupling on a rod in such relation to the spring catch and the cock, that by exercising a pressure on the coupling, the rod is turned sufficiently to open the cock, and to depress the spring catch.

109. MAIL BAGS; Thomas J. Lamdin, Baltimore, Maryland.

Claim—The placing of the staples or buckles on the flap of the bag or pouch, so that when the flap is turned down, said staples or buckets will pass through the grummets. Also, the manner of forming the seams of the bag or pouch, so that they cannot be cut open and re-sewn from the outside of the back without instant detection on looking at the seam, as its whole character must be changed in any such attempt or effort.

110. APPARATUS FOR CONDUCTING WATER TO CISTERNS; Jabez Lewis, New Orleans, Louisiana.

Claim—Making the change in openings from the box, or its equivalent, by the employment of a weight containing water supplied from a roof, when the weight can lose the water it contained, and thus reduce its force of gravity to allow another change to be made, by which the water is conducted in separate directions from and to the cistern.

111. JIB-BOOM FOR VESSELS; Charles L. Linnell, Truro, Massachusetts.

Claim—The application of the after jib-boom to the bowsprit by means, not only of the slide rod applied to the bow-sprit, but the slider connected with the boom.

112. SPOKE-SHAVE; Benjamin Tolman, Assignor to self and A. T. Ramsdell, Pembroke, Massachusetts.

Claim—A spoke-shave, constructed with an adjustable knife and adjustable throat gauge, arranged and applied to the stock so as to move with respect to one another.

113. BENCH PLANE; Wm. S. Loughborough, Rochester, New York.

Claim—1st, The combination of the screw, 2 (which takes effect in the projection, R), spring or yielding cap, bit, and screw, 1, for the purpose of varying the cut of the bit, and at the same time, and proportionally, the space of the throat, the base of the bit being the fulcrum upon which it swings when said changes are made, the said combination being applicable for the adjustment of the bit in all kinds of planes. 2d, The adjustable parallel fence, constructed with diagonal slots for the set-screws, said fence being applicable to match planes, and also the stop with the slot running up diagonally from the face, the set-screw, and the guide pin keeping it in position, said stop being applicable to panel ploughs and dadoes.

114. IMPROVED ROTARY ENGINE; Samuel D. Lount, Summerville, Michigan.

Claim—The arrangement and combination of the rotating head, provided with sliding pistons, and placed eccentrically within the case, the saddles applied to the pistons and the valves.

115. APPARATUS FOR LAYING METAL LEAF ON MOULDINGS, &c.; Robert Marcher, City of New York.

Claim—The method of laying leaf metal on mouldings, and other surfaces, by means of a roller. Also, operating the roller in laying leaf metal on surfaces by the force of capillary attraction. Also, the combination of the rails, the table for holding the book of leaf metal, and the means for holding the article to be gilded or silvered, or the equivalents of the said elements, in combination with the roller. Finally, the combination of the roller and rails, or equivalent guide ways, with the rebate, or equivalent gauge.

116. RAILROAD SWITCH; T. Mayhew, Poughkeepsie, New York.

Claim—The employment or use of the adjustable platform, in connexion with the switch bar and gearing, springs and stops.

117. PUMP BOXES, John Munson, San Jose, California.

Claim—Constructing the pump boxes of the rings and bands, provided with the uprights and the traverse plates, when the boxes thus constructed are provided with the valves fitted thereon. Further, securing the lower box in the bottom of the cylinder, by means of the traverse plate on said box, and flanch, secured to the inner side of the cylinder.

118. PLANT PROTECTORS; Eli Mosher, Flushing, Michigan.

Claim—The arrangement and combination of the folding sides, cover, and fastening cord.

[These protectors are simply rectangular wooden boxes covered at the top with gauze or some other material which will admit the sun's rays, air, and moisture, and at the same time exclude the insects; the boxes being set over the plants they are to protect.]

119. WIND-MILLS; Wm. McAllister, South Reading, Massachusetts.

Claim—The series of narrow sails attached to vertically sliding rods, and united by means of the cords, and operating in combination with the adjusting ropes.

120. PLOUGHS; James C. Molthrup, Bucyrus, Ohio.

Claim—Giving the beam longitudinal and vertical motion by means of the bearing plates, slots, short rear bolt, b, and long vibrating front bolt.

121. MANUFACTURE OF FELT HATS; James Monach, Rahway, New Jersey.

Claim—The corrugation of the brims of felt or soft hats by the employment of dies on both sides of the brim, whereby the corrugation is attained without stretching the brim, both the surfaces being finished at one operation.

122. ROASTERS; James Mulligan, City of New York.

Claim—The detachable journal bearings, constructed so as to be clamped on to the edges of the openings in the stove or range, and receive the spit.

123. PLOUGHS; Williamson Nichols, Floyd Co., Georgia.

Claim—The arrangement of the forked beam, segmental head, holes, bolts, clevis, stock, handle, rivet and holes.

124. BRIDLES; R. B. Norvell, Huntsville, Alabama.

Claim—The cord, attached to a bridle or halter by passing the same through the bit rings or halter rings, and over the pulleys, or their equivalents, and under the throat of a horse, or other animal.

125. IRON TIES FOR COTTON BALES; James Nuttall, New Orleans, Louisiana.

Claim—The combination of the plate and movable clasp, when made use of in confining the hooks as a fastening for iron ties for cotton bales.

126. CLOTHES FRAME; Henry A. Nutting, South Amherst, Massachusetts.

Claim—A clothes frame, composed substantially of the rod or stem, the two hubs, and the two sets of arms.

127. CULTIVATORS; Isaac B. Palamountain, Tarboro', North Carolina.

Claim—The arrangement of the beam, stock, centre bar, standard, wings, share, and seat.

128. HORSE HAY-RAKES; George S. Reynolds, East Bethel, Vermont.

Claim—The arrangement of the boxes, arch arms, elastic spring, shoe, strap, t, frame, and strap, l.

129. TOOLS FOR MANUFACTURE OF FIRE ARMS; Augustus Rebetey, Norwich, Connecticut.

Claim—The use of a crank shaft to carry a cutter, such crank shaft suspended at the centres of an engine lathe, or any similar machine, and receiving its motion from the counter-shaft of such lathe, or similar machine, for the purpose of cutting an eccentric shaped slot in the barrel of a pistol, or anything else.

130. WATER WHEELS; Sylvanus Richardson, Jericho, Vermont.

Claim—The construction and arrangement of the shutes formed by irons, and the arrangement of openings in plate f, in fig. 3, and corresponding openings in plate f, in fig. 5, and the arrangement of plate, c c, and wheel, and case, and draft tube, and the combination of the same.

131. HEMP BRAKES; John W. Rinehart, Lexington, Missouri.

Claim—The particular manner of operating the beater frame, by means of the lever, j, links, lever, l, shaft, arm, connecting rod, and crank.

132. HERNIAL TRUSSES; S. S. Ritter, Philadelphia, Pennsylvania.

Claim—1st, The construction of a surgical truss having a short spring with one or more plates of metal, extending in front about half round the body, and held by a strap or straps, forming the other half of the girdle, when the said spring is curved, as shown, for the purpose of making a more agreeable pressure on the hernia, and for fitting the ends of the spring better to the hips, thus rendering the truss more comfortable to the patient. 2d, The described pad, having a central prominence surrounded by a groove and ridge, when the face of said pad is made in one piece.

133. APPARATUS FOR VULCANIZING RUBBER; Edward A. L. Roberts and Wm. J. Demorest, City of New York.

Claim—The general arrangement of the stove, boiler, and vulcanizing chamber.

134. GRAIN SHOVELS; David B. Rogers, Pittsburgh, Pennsylvania.

Claim—The so bending a plate of iron into the shape of a shovel as to form a socket for the handle out of the same piece of iron.

135. CLOCK DIAL; S. E. Root, Bristol, Connecticut.

Claim—The combination of a clock dial, metallic back, and frame, specifically as described.

136. PRINTING PRESSES; Stephen P. Ruggles, Boston, Massachusetts.

Claim—1st, The combination of two screws having different sized threads, and operating together to give a greater motion to a platen, or its equivalent, at one time, and more power at another time, as may be desired. 2d, Connecting two such screws together, and to the lever or bar that actuates them, by a strong helical spring, that, by being wound up, becomes a clamp, so as to put the two screws in action one after the other. 3d, Running out the bed of the press on inclined ways for the purpose of increasing the distance between the bed and platen, which makes a better entrance for the frisket, blanket, sheet, form, &c., by affording more space when they are being run under the platen.

137. Automatic Primer for Fire Arms; Jacob Rupertus, Philadelphia, Pennsylvania.

Claim—1st, The feeding slide lever, applied in combination with the hammer to constitute a portion of the thumb-piece thereof, and with an interposed spring. 2d, Constructing and applying the feeding piston to roll within the magazine, as set forth. 3d, Attaching the feeding piston which drives the priming forward in the magazine to a spring or flexible driver, which winds on and off a spring barrel.

138. Pumps; John Selser, Williamsport, Pennsylvania.

Claim—1st, Draining the standing pipe and relieving the air chamber from pressure by allowing the water to escape upward through the cylinder, whenever the plunger rod is sufficiently depressed, thereby draining the pipe without draining the pump itself. 2d, The splash plate with its aperture, when used in connexion with the vertical termination of the discharge pipe.

139. Shafting for Endless Chain Horse Powers; Theodore Sharp, Bloomington, Illinois.

Claim—The sliding shaft, reels with slotted or mortised hubs, constructed and operating as described.

140. Seed Planters; David M. Smith, Springfield, Vermont.

Claim—The combination of the following devices for operating the dropping slide, viz: the spring, the rack, the pinion, the rack lifter, the groove of the rack, and the latch. Also, the application of the rack lifter to the rack so as to be adjustable thereon, in the manner set forth. Also, combining with the rack and apparatus carried by it, the latch elevator for moving the rack out of gear with the pinion, and holding the rack from slipping or being thrown backward, the object being not only to prepare the rack for causing the machine to plant the first dropping of seed in the right place, but to hold the rack out of gear with the pinion while the machine is being moved over the ground, where it may not be desirable to have it plant seed.

141. Rotary Steam Engines; Mathew Smith, Pittsburgh, Pennsylvania.

Claim—The combination and arrangement of a revolving cylinder, steam chest, cam yoke, supply and exhaust passages, with a stationary cam, supply and exhaust chambers, when combined and operated as described.

142. Lathes for Turning Irregular Forms; Charles and Andrew Spring, Boston, Massachusetts.

Claim—The combination of a griping chuck by which an article can be so held by one end as to present the other free to be operated upon, with a rest preceding the cutting tool, when it is combined with a guide cam, or its equivalent, which modifies the movement of the cutting tool.

143. Apparatus for Superheating Steam; George A. Stone, Roxbury, Massachusetts.

Claim—A steam jet, or the equivalent thereof, located substantially in the position and serving the purposes specified, in combination with a superheating apparatus, which is heated by a portion of the gaseous products of combustion.

144. Raking Attachment for Harvesting Machines; George Tatlock, Salem, Indiana.

Claim—Operating the rake-head which is pivoted to the sliding bar through the medium of the rotating shaft, connecting rod, rock shaft, connected respectively with the rod and sliding bar by the arms, in connexion with the arm attached to the rake-head, the loop or guide attached to the arm, and the bars or arms attached to the platform.

145. Bureau Bedstead; H. L. Thistle, City of New York.

Claim—Combining the bedstead frame with the wardrobe, or other case, by means of the hinged links and movable slides, whereby the bed can be let down to a lower level than by any other construction before known, while at the same time it can be let down by a single movement, and within a space no longer than the bedstead, and without the necessity of first drawing out part of the structure from the wall, or making joints in the side rails or pieces, the hinged links and slides giving to the structure all the foregoing advantages. Also, in combination with the bedstead frame connected with the case by the hinged links and slides, the weighing of the head end of the frame to balance the weight of the foot end when lifting it up, and thereby facilitate the manipulation. Also, forming the support for the foot end of the bedstead frame by a hinged panel, so that the said support, when the bed is thrown up, shall form part of the front of the wardrobe, or other piece of furniture.

146. Harvesting Machines; Samuel Thomas, Burnett, Wisconsin.

Claim—The false pole with its attached sliding gauge, which may be adjusted at pleasure, so as to prevent side draft and pressure upon the near horse.

147. Rotary Harrows; George W. Toleman, Augusta, Kentucky.

Claim—The arrangement of the frame, shaft, iron circle, roller, rods, and rod or hook, operating conjointly, as set forth.

148. Stoves; John Van and Henry V. Barringer, Cincinnati, Ohio.

Claim—The swinging grated door or hearth, and sliding swinging register, in combination with the supporting legs and stove, arranged as set forth.

149. Hillside Ploughs; Edward Van Camp, Beadington, New Jersey.

Claim—Making the share, the landside, and the landside brace of hillside ploughs, each in one piece, and uniting them together to the mould-board and beam, in the manner set forth.

150. Grain Separators; James Vaughn, Magnolia, Illinois.

Claim—The arrangement and combination of the semi-cylindrical hopper having a depression in its centre, with the screen, buckets, spout, D, fan, and spout, I, as described.

151. Meat Slicer; Wm. Vine, Hartford, Connecticut.

Claim—The beveled lip and the pendant, for the purpose described, in combination with the other parts of the dried meat slicer.

152. Lock; Thomas K. Webster, Lawrence, Massachusetts.

Claim—The guard or fender, as described.

153. Churn; Leonardo Westbrook, City of New York.

Claim—The use of the projecting rim and the revolving disc working over the same, in combination with the fixed and revolving radial dashers, and with or without the regulating thumb-screw.

154. Ice-pick; Milton, Howard, Henry T., and Joseph White, Philadelphia, Pennsylvania.

Claim—The combination of the ball and tube sliding upon the stem, in such a manner that the blow may be struck upon the head of the stem.

155. Stoves; John George Widmann, City of New York.

Claim—The arrangement and combination of the gas tubes with the cylinder and fire openings, so that the gases which arise from the heating of the coal will be compelled to pass down into the fire.

156. Harvesting Machines; Hosea Willard and Robert Ross, Vergennes, Vermont.

Claim—1st, The arrangement and combination of the hinged bar with the lever, as described. 2d, The arrangement and combination of the adjustable spring, bar, adjustable rod, spring, and finger bar, as described.

157. Harvesting Machines; Wm. H. Wilson, Denton, Maryland.

Claim—1st, The combination of the vibrating sector, rack, lattice frame, and carriage, with the beam, or its equivalent, and the rake. 2d, In combination with the rake having its centre driven backward and forward over the platform, the swiveling plate, ratchet, and pawl, and adjustable shifting stop, or its equivalent, whereby the rake is turned upon its centre and caused to sweep the grain off. 3d, In combination with the rake having its centre driven back and forth over the platform, as specified, the guiding plate and rolls, or their equivalents, whereby the rake is thrown back into the proper position to sweep across the platform after having discharged a sheaf. 4th, The combination of the rod, M, with the rod, s, arm, cam, and spring. 5th, The stop, arranged as described.

158. Combined Metallic Street Curb and Gutter; Wm. E. Worthen, City of New York.

Claim—The compound metallic curb and gutter, constructed in the manner specified.

159. Ploughs; T. J. de Yampert, Shohola, Pennsylvania.

Claim—A revolving cone having under-cut or overhanging curved flanches or wings that extend entirely from the base to the point of the cone, so that it will revolve upon its shaft or journal by the resistance of the earth alone against it, and without being driven by other forces. Also, in combination with a cone furnished with spiral under-cut flanches, and revolving by the resistance of the earth against it, the mould-board and landside for turning over the loosened earth, and directing the plough in its path, as described.

160. Pruning Knife; G. G. Belcher, Assignor to self and Joseph S. Hill, Worcester, Massachusetts.

Claim—1st, Arranging the blade of a knife in such a manner that it opens and closes by turning one or both parts of the handle. 2d, The pins on the blade, arranged in combination with the slots in the plates of the handle, for the purposes of operating the blade and keeping the same rigid when it is opened as well as when it is closed. 3d, The slide, or its equivalent, arranged in combination with the eye, for the purpose of securing the two parts of the handle together.

161. Boot-crimping Machines; James D. Black, Assignor to self and Ezekiel Hallet, Jr., Boston, Mass.

Claim—Machines for crimping boot-legs, in which the "hitch-on" is raised by the hand of the operator, pivoting the device by which the "hitch-on" is raised to a spring clock, or its equivalent. Also, the peculiar construction of "hitch-on" described, the movable jaws being temporarily closed upon both sides by a spring, so that they may be separately opened for the insertion of the leather, and may be permanently closed by a single screw.

162. Hand-plane; Simeon S. Dodge, Sunapee, Assignor to self and Edmund Burke, Newport, N. H.

Claim—1st, The curved adjustable cap iron, constructed as described. 2d, The combination of the adjustable cap iron with the bolt, the set-screws, the thumb-screw, and the break iron, as described.

163. Knapsacks; Wm. Griffiths, Assignor to self and Joseph H. Lambert, Philadelphia, Pennsylvania.

Claim—A military knapsack having the usual frame or case, made and adapted thereto, so as to be convertible.

164. Corn Planters; Wm. H. King, Assignor to self and Nelson Colson, Charleston, Illinois.

Claim—1st, In combination with the cams and the arm, the arrangement of the rods in such relation to the seed cells that they push out the corn contained in the same. 2d, The arrangement of the marker, in combination with scraper, so that the same never fails to make a clear mark in the track of the driving wheel.

165. Seed Drills; Charles Learned, Assignor to self and George P. Stevens, Indianapolis, Indiana.

Claim—The guard or series of straps, in combination with the toothed roller and elastic guard, when operated in connexion with the roller and agitator.

166. Making Steels for Sharpening Knives; Samuel Lee, Assignor to Charles S. Pomeroy, Taunton, Mass.

Claim—The combination of these devices, so that by their continued action they shall produce a steel with sharp ribs or edges in the direction of its length.

167. Cooking Stoves; Henry G. Leonard, Assignor to Lemuel M. Leonard, Taunton, Massachusetts.

Claim—So constructing and arranging one or more of the oven plates of the stove, that it or they can be removed, and the flue or flues cleaned, and the plates replaced, without loosening or separating the plates which form the outside of the stove. Also, making one or more of the interior flue plates, so that it can be removed and the flue cleaned, and the plate replaced, without loosening or separating the plates which form the outside of the stove.

168. Single Thread Stitches; James S. McCurdy, Assignor to Elias Howe, Jr., Brooklyn, New York.

Claim—A single thread interlooped stitch, in which each successive loop is encircled by a tight coil of the thread of the preceding loop.

169. Device for Suspending and Liberating Ships' Boats; Daniel P. Mealey, Assignor to self and A. E. H. Johnson, Washington City, D. C.

Claim—The hanger, constructed with a seat or seats for the ring of the boat to rest upon, in combination with the seat formed in the tumbler, in such manner that the seat or seats of the hanger shall coincide with the seat in the tumbler, that a large proportion of the weight and strain may be supported by the hanger, which increases the power of the device to resist strains, and facilitates the unlatching of the tumbler. Also, in combination with the arrangement of the opening in the tumbler, in combination with the seats and that portion of the hanger which rises above and overhangs them, in such manner that when the seats of the hanger and tumbler coincide, the mouth of said opening will pass and be inclosed by the

hanger. Also, in combination with the tumbler and hanger, extending the legs of the hanger below the range of motion of the opening in the tumbler, so as to form a cut-off to the passage of the ring, and thus prevent it from being carried round with the motion of the tumbler. Also, in combination with a boat detacher making a recess or shoulder in the tumbler, in combination with a snug or projection on the dead eye, whereby the connexion of the ring of the boat with the tumbler may be made with one hand, when necessary.

170. CHURN; James O. Merrill, Assignor to Wm. A. Swain, Chichester, New Hampshire.

Claim—The arrangement of the oscillating lever and its weight with the vibrating shaft, the vibrating lever, the auxiliary levers, and the alternate reciprocating dasher arms, with their dasher, by which the oscillating power of the pendulum is applied to the process of churning butter.

171. FACTITIOUS ENAMELED LEATHER; James W. Munroe, Assignor to John Southworth and Wm. R. McKenzie, Fall River, Massachusetts.

Claim—The artificial leather, composed of two or more thicknesses of cloth united by cement and varnish, as set forth.

172. MACHINES FOR DIGGING AND GATHERING POTATOES; Jonathan B. Parvin, Assignor to self and Elias Stratton, Heightstown, New Jersey.

Claim—The combination of the weed cutter and roller, when mounted on a swivel and applied to a potato digger. Also, hinging the frame that carries the plough and the endless apron on the shaft, when used in combination with the lever, links, and rods, by which the operator from his seat can raise up, lower, or hold up the plough and apron. Also, the combination of the adjustable endless apron, horizontal and vertically vibrating grate, and the elevating apparatus.

173. BASIN COCK; G. W Randall, Assignor to Reuben J. Todd, Boston, Massachusetts.

Claim—The wash basin cock or faucet, as made with cold and hot water inlet passages, and the column passages, arranged in the socket and column, and with respect to the discharging spout, in order to enable a person, by turning the movable part or parts, to discharge either cold or hot water, or a mixture of the same from the faucet, or to close off both hot and cold water induction passages, as circumstances may require.

174. TOOLS FOR MANUFACTURING PISTOLS; Augustus Rebetey, Norwich, Connecticut, Assignor to the Manhattan Fire Arms Manufacturiug Co., City of New York.

Claim—The use of a frame having a profile in one plate of it, to shape and finish a corresponding recess in the side plate of a pistol, by means of a revolving cutter governed by the outlines of said profile.

175. ROTARY CUTTERS AND MODE OF OPERATING THEM FOR MOULDINGS; Frederick Schute, Assignor to self and Philip P. Weis, Philadelphia, Pennsylvania.

Claim—A revolving cutter, with any convenient number of double cutting edges of the form of the tongue, groove, bead, or hollow to be cut—one cutting edge being the reverse of the other in each pair, so that one cutting edge only of each pair shall have a cutting effect, when the cutter revolves in one direction—the other edge to cut when the cutter revolves in a contrary direction, and so that one cutting edge of each pair shall act as a guard, to prevent the adjacent edge from penetrating too deep into the wood, when the said cutter with double-cutting edges, thus constructed, is secured to a spindle capable of having the direction of its rotation readily reversed.

176. STEAM ENGINES; G. F. Lombard, New Orleans, Louisiana; patented in England, October 10, 1857.

Claim—1st, The relative arrangement of two cylinders, four pistons, two rocking beams, two steam chests with valves, and the specified connexions which combine and operate the same, in the manner set forth. 2d, The application of the exhaust steam of the engine to the crank or eccentric shaft, through a fly-wheel, constructed and combined with the engine and crank shaft.

177. STEAM ENGINE; J. A. Whipple, Assignor to James Whipple and B. F. Cooke, Boston, Massachusetts.

Claim—The described intermittent rotary engine, consisting of the cylinder, the heads, and pistons.

178. STEAM AND WATER GAUGE; Cornelia H. Williams, Williamsburg, New York, (Administratrix of the estate of Augustus Williams, deceased,) Assignor to Anthony Pollak, Washington City, D. C., Assignor to A. N. Clark, Beverly, Massachusetts.

Claim—1st, Combining the vessel separate and distinct from, but connected to, the boiler by means of two pipes containing a float having an indicator or pointer attached thereto, with the transparent tube or steam chamber. 2d, The general arrangement of the instrument for forming an alarm water gauge, by combining with the water gauge a whistle, attached to a separate chamber containing a valve arranged to be operated by the float, so as to admit steam to said whistle, to give alarm when required.

179. HORSE-SHOE MACHINE; J. B. Collen, Assignor to self and Pascal Yearsley, Philadelphia, Pennsylvania.

Claim—1st, Bending the heated bar of iron to the requisite form, by applying it to a revolving former of the shape of the inside of the shoe, when the said former is arranged to hold the bent iron, while it is acted upon by the dies. 2d, The combination of the revolving former with the cutter, when the latter is so arranged in respect to the former, that the edge of the cutter shall coincide, or nearly coincide, with the circular path traversed by the outer edge of the former, and when the cutter is hung to the movable bar, or its equivalent. 3d, The die, the spindle, its former, and the sleeve, in combination with the counter-die on the spindle.

180. CORK MACHINE; Albert Albertson, Assignor to C. C. Bean, City of New York.

Claim—1st, The stationary cylinder, or any substantially equivalent device, when employed to gripe a cork by its periphery, so as to effectually prevent its rotation while being cut by a rotary cylindrical cutter. 2d, The feed rollers (with or without the band), arranged and adapted to rotate a cork by friction upon its periphery, while under the action of a longitudinal cutter.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Connexion between the Structure and the Physical Properties of Wood.** By Prof. KNOBLAUCH.

From the "Sitzungsberichte der Naturforschenden Gesellschaft." Halle, 1858, vol. v.

The author seeks to ascertain *whether any connexion is ascertainable between the structural relations of various kinds of wood and their observed physical properties, such as their powers of resonance and conduction of heat, &c.*, in the same way as was done for one and the same wood by Savart in respect to resonance, and more especially by Tyndall in respect to the conduction of heat.

The primary object was to trace the difference in the conduction of heat shown by different woods, according as the heat has to traverse the wood in a direction parallel with, or at right angles to, the direction of the grain. For this purpose, slabs of the woods to be examined were bored through perpendicular to their planes, and then covered as uniformly as possible with a coating of stearine. A hot wire, exactly fitting the bore, was introduced into the latter and continually turned round during the experiment. By this means the coating of stearine around the orifice was melted; but, as we should expect, not in concentric circles, but in elliptic zones, whose major axes invariably coincided with the direction of the grain. The great difference in the behavior of different kinds of wood (about eighty sorts were examined,) under these circumstances is at once apparent. With some the ellipses are tolerably circular, by others more elongated, while by others, again, the major axes are so extended as to be nearly twice the length of the minor ones. The eccentricity of these ellipses, which furnished a graphical expression for the conductive power of the wood in the directions between which the structural difference was greatest, made it possible to divide the different kinds of wood into four distinct groups. In the first, the ratio of the minor to the major axis of the ellipse is on the average as 1 to 1·25. To this group, Acacia, Box, Cypress, King-wood, &c., belong. In the second, and by far the most numerous group, containing Elder, Nut, Ebony, Apple, several dye-woods, &c., the mean value of this ratio is 1 to 1·45. In the third group, to which Apricot, Siberian, Acacia, Brazil wood, Yellow wood from Puerto Cabello, &c., belong, the ratio is as 1 to 1·60. In the fourth group it is as 1 to 1·80, and to this division belong Lime, Tamarind, Iron wood, Poplar, Savanilla (yellow), &c. Hence, *the conducting power of all woods in the direction of the fibre exceeds that in the perpendicular direction by no means in a constant manner, but in one which depends upon the nature of the wood.* This superiority is in the first group so small, that the warmth in the direction of the fibre traverses a path only a quarter more in length than that traversed in the same time in a perpendicular direction. In the last group, on the other hand, the length of the path in the first direction is about twice that in the perpendicular one.

* From the Lond., Edin., and Dub. Mag., May, 1859.

In order to investigate the relations of resonance, two rods were cut from each kind of wood,—the one being taken in the direction of the grain (Langholz), the second perpendicularly across it (Hirnholz). On suspending these rods freely (their length was 470 millims., breadth 20 millims., and thickness 8 millims.) and striking them with a stick, the piece cut with the grain always gives a more sonorous tone than the corresponding cross-grain piece. Nevertheless, the difference of resonance in the tones of the width and cross-grain pieces of one and the same wood, of the first of the groups described (say beech), is unmistakably less than the difference between the tones of the with and cross-grain pieces of any member of the second group. In the second group this difference is less than in the third; and in the third, again, less than in the fourth (as with with- and cross-grain pieces of poplar). *When, therefore, the fibres of all kinds of wood are set in vibration, the purity of resonance is greater when such vibrations are transverse than when they occur in other directions (as when the rods are cut across the grain). But this superiority of resonance is not constant; it depends upon the nature of the wood.* The difference in this respect in the first group of woods is so small, that the resonance of two with- and cross-grain pieces resembles that of two not very dissimilar masses of stone when struck. In the last group the difference is so great, that the tone of the with-grain piece when struck has a metallic ring, while the dull sound of the cross-grain piece reminds one of a piece of pasteboard when struck. *The division of the woods examined, derived from their thermo-conductive power, is accordingly supported by their acoustic relations.*

By supporting the two ends of the rods employed in the above experiments and loading them equally in the middle, the degrees of deflexion which they undergo will give us an insight into their structural relations; for the greater their compactness, the greater the resistance they will offer to bending; and the less compact they are, the more easily will they yield. The difference in vertical height of the middle points of the bent and straight rods was taken as measure of deflexion. A lever was employed to determine this measure, the end of which passed over an enlarged scale in order that the readings off might be the more exact. The unit of this measure was a matter of indifference, inasmuch as in the comparison to be instituted, relations only had to be determined. Although, as was to be expected, in all cases the with-grain piece was much less flexible than the corresponding cross-grain piece, yet an important difference was noticeable in the different groups. This is best seen by calculating the relation between the bending (measured as above described,) of the with-grain and that of the cross-grain wood; that is, the same weight being applied (say 100 grs.), by dividing the number given by the lever with the cross-grain piece by that given with the with-grain piece. This relation (called "ratio of deflexion" in the following Table) has, in the first group, the mean value of 1 to 5; in the second, 1 to 8; in the third, 1 to 9·5; in the fourth, 1 to 14. The division of the

groups is therefore also supported from this point of view.* *The difference in the structure in the different directions is least in those woods which show the least difference with respect to direction in their thermo-conductive and resonant properties; and the difference in the former is greater or less as the two latter differences are greater or less.*

Hence, a definite relation may be established between the different phenomena described; and this is true to such an extent, that the knowledge of one of them, e. g., the mechanical or state of cohesion is sufficient to deduce the others, those of warmth or resonance.

Thus, merely to adduce one example, especial experiments had shown that in petrified woods a difference of structure in the directions parallel with, and perpendicular to, the direction of the grain had been preserved, and, in fact, the thermal curve was an ellipse whose major axis was parallel to the fibres. As in the petrified example, this difference in mechanical structure was much less than in the living wood, so, also, while in the living Conifer the ratio of the axes was as 1 to 1·80, in the petrified specimen it had sunk to 1 to 1·12.

The following Table contains the names of the woods examined, arranged according to the groups mentioned:—

Group I.

Ratio of the axes of the thermal ellipse 1 to 1·25. Mean ratio of deflexion 1 to 5·0.

Acacia.	King wood.
Box.	Satin wood.
Lignum-vitæ.	Salisburia (*Gingko*).
Cypress.	

Group II.

Ratio of axes of thermal ellipse 1 to 1·45. Mean ratio of deflexion 1 to 8·0.

Elder.	Snake wood.
Alder.	Zebra wood.
White Thorn.	Purple wood (*Amaranthus*).
Arbor vitæ.	Settin.
St. Lucian wood.	Coromandel wood.
Gymnocladus canadensis.	Angica wood.
Beech (2 species, white and red).	Cocoa wood (*Gateado*).
Plane.	Apple.
Elm.	Pear.
Oak (two species).	Cherry.
Ash.	Plum.
Maple.	Sandal (red).
American maple.	Caliatour.
Cedar of Lebanon.	Costarica (red wood).
Australian cedar.	Bimas sapan.
Mahogany.	Cuba (yellow wood).
Palisander.	Viset (yellow wood).
Ebony.	Campeachy blue wood.
Palm.	Tobasco blue wood.
Rosewood.	Domingo blue wood.

Group III.

Ratio of axes of thermal ellipse 1 to 1·50. Mean ratio of deflexion 1 to 9·5.

Apricot.	Pernambuco red wood.
Pistachio.	Japan red wood.
Siberian Acacia.	Puerte-Cabello yellow wood.

* The diversity of nature, even with one and the same kind of wood, of course did not admit of the boundaries of the groups being drawn with great exactness, or of the subdivision of the groups into secondary ones.

GROUP IV.

Ratio of the axes of the thermal ellipse 1 to 1·8. Mean ratio of deflexion 1 to 14·0.

Willow (two examples).
Chestnut (three examples).
Lime.
Alder.
Birch.
Poplar (three examples).
Aspen.
Pine.
Fir.
Weymouth fir.
Magnolia.
Iron wood.
Tamarind.
Palmassu.
"Kistenholz."
Caoba (Havanna Cedar).
Savanilla yellow wood.

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*Electro-telegraphic Progress.**

A foreign scientific journal gives the following summary of the different lines where submarine telegraphs have been laid, up to the end of 1858.

Dates.		Length in miles.
1850.	England and France,	22¼
1852.	England and Belgium,	70½
"	England and Ireland,	64
1853.	England and Holland,	107½
"	Ireland and Scotland,	24¼
1854.	Italy and Corsica,	64
"	Corsica and Sardinia,	9¼
"	Denmark (Great Belt),	14¼
"	Denmark (Little Belt),	4½
1855.	Denmark (Channel of the Sound),	11⅛
"	Scotland (Frith of Forth),	3½
"	Black Sea,	371¼
"	Solent (Isle of Wight),	3
1856.	Straits of Messina,	4¾
"	Gulf of St. Lawrence,	74
"	Strait of Northumberland,	9¼
"	The Bosphorus,	1⅛
"	Nova Scotia (Isthmus of Canso),	1¼
"	St. Petersburgh and Cronstadt,	8
1857.	Sicily and Algeria,	149½
1858.	Bay of Valentia (Ireland) and that of Trinity (America),	1827¼
	Total in 1858,	2771¼

* From the Lond. Builder, No. 844.

Use of Birds.

The *Bulletin* of the Brussels Society for the protection of animals, published the following curious and interesting fact:

Until a few years ago, the Park at Brussels was shaded by trees of luxuriant foliage which met over the alleys and screened the promenaders entirely from the sun. These trees were filled with birds whose indiscretions occasioned now and then a little annoyance to the elegant toilettes below. For this reason they were banished; in a few weeks, the

leaves of the trees were in holes and dying—and now, the branches almost entirely without verdure, and loaded with caterpillars, and the walks infested with moths. *Cosmos.*

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*On Professor Hughes' System of Type-printing Telegraphs and Methods of Insulation, with special reference to Submarine Cables.** By Mr. H. HYDE.

The several phenomena which have been manifested in the working of long submarine telegraph cables, demonstrate the necessity of improving the insulation of the wires, and of economizing the transmission and recording of symbols. Imperfect insulation not only implies a diminution of the electric current, but may, and frequently does, increase to a total loss, and the cable becomes useless.

The insulation being good when the cable leaves the manufacturer, it is subject to so many accidents before it reaches the bottom of the ocean, that the chances are greatly in favor of a long line receiving some damage, which cannot be repaired after it is laid down. More perfect insulation, and a self-restoring power which should make the cable itself, even at the bottom of the ocean, repair any accidental defect, are most important desiderata in the science of ocean telegraphing.

The great expense of a length of cable, of any construction, sufficient to join England and America, must necessarily be such as to render economy of time in the transmission of messages a matter of primary importance.

Through a single wire, the waves of the electric force can only follow one another in single file. Whatever may be the time occupied in the transmission of a single wave, it is of no small importance, whether it takes from five or six, or only a single wave, to communicate the signal of any letter of the alphabet. The short experience of the working of the Atlantic cable has demonstrated the importance of these positions. I need therefore offer no apology to the members of the Society of Arts, for bringing before them the methods by which Prof. Hughes seeks to improve the insulation of submarine and other wires, to render them self-repairing, and to economize and render at the same time the means of despatch accurate and self-recording.

First—Insulation.—Gutta-percha has been found to be the best insulation for long submarine lines. This substance, however, is more or less porous; minute flaws may exist, which do not show themselves until some time after the immersion of a cable. This was exemplified by Mr. Henly, who discovered a flaw in his submarine cable, which did not show itself until it had been three or four days under water. To meet these defects, to fill up any minute pores in the gutta-percha, and also to cure any accidental fracture or puncture of it, Prof. Hughes introduces a viscid semi-fluid substance, of a non-conducting character, between the conducting wire and the gutta-percha, or the wire may be first coated with gutta-percha, and the viscid fluid introduced between the layers of gutta-percha. As soon as a puncture is

* From the Jour. of the Society of Arts, No. 321.

made in either of the gutta-percha coatings, the semi-viscid fluid oozes out. It is of such a nature, that it hardens when it comes in contact with the surrounding water.

This hardening or coagulating property allows no more of the fluid to ooze out than is necessary to fill the fracture, and at the same time to glue and unite the separated parts of the gutta-percha.

The first feature in this form of cable is its self-restoring power; but it has another, and perhaps more important one. It has been shown, I think by Prof. Faraday, that a fluid which cannot be decomposed by electricity is the most perfect insulator. Should this be demonstrated in practice, the invention of this form of cable must be valuable as a means for greatly increasing the non-conducting power of the medium surrounding the conducting wire. It is well known that cables become defective in insulation after being submerged for some time. It has been supposed that the forces of the electric current burst the gutta-percha covering under certain circumstances. It has also been urged that, in consequence of this tendency, battery power should be used instead of induced currents.

Professor Hughes has demonstrated that voltaic currents exert no mechanical force whatever upon the insulating coating of a conducting wire.

If there be a defect in the coating it may be enlarged by strong currents, either voltaic or induced. But, if there be no pore or crack through which the current can first commence its work of destruction, no voltaic current would exert sufficient force to tear a piece of paper. This has been shown by putting a piece of cable, three feet long, made upon Prof. Hughes's plan, into a bath of salt water. Its complete insulation was tested by a delicate galvanometer and a battery of 500 cells. A fracture, an inch long, was then made through the gutta-percha and the viscid substance, allowing the salt water to reach the wire; the galvanometer immediately was deflected from zero to 90°, showing dead earth.

In the course of five or ten minutes the viscid substance worked its way around the uncovered wire, and oozed out to the water through the fracture. It then coagulated, and thus repaired the injury, and completely restored the insulation. The whole force of the current from the 500 cells was kept constantly passing into the wire during the whole of this operation.

In illustration of the varied effects of different descriptions of fractures upon submerged cables, it may be instructive to note that if the conducting wire be made bare by a fracture of considerable size, having breadth as well as length, the immediate effect will be dead earth, or the instantaneous deflexion of the needle to 90°. If the fracture be fine or narrow, the effect will be a deflexion of the needle to a greater or less extent, say from 70 or 90°, with a constant vibration of from five to ten degrees or even more. This deflexion and the vibrations will continue as long as the current is kept upon the wire, and often resemble the vibrations produced by a manipulator. This peculiar phenomena may, in some degree, account for the peculiar vibra-

tions which so much puzzled the electricians during the short life and last moments of the Atlantic cable. These vibrations are probably produced by the decomposition of water by the electric current. The hydrogen gas escaping from the point of contact with the wire in an elongated bubble fills the fracture while passing through it, thus alternately opening and closing the circuit.

Secondly—Instruments.—In the early history of electric telegraphing, inventors were impressed with the advantages of using the alphabet in general use for transmitting communications, instead of characters or symbols, a mode which naturally suggested itself as the best, if practicable.

While electrical knowledge was confined to but few, mechanical knowledge, as applicable to its development, was also limited in the same or a still greater ratio. Hence, the mechanical means by which electric currents were made to convey or record signals were crude and simple, and the work was, if not cheaply, at least slowly, roughly, and often inaccurately done.

Among the earliest applications of electro-magnetism to telegraphic purposes, was the vibration of a magnetic needle to the right or left, at the will of the operator, by passing an electric current through the apparatus, or around the needle.

These vibrations are arranged into a code of signals, and the receiver spells off the message from the moving needle, and translates the signals to an amanuensis, who commits them to paper. But in the event of errors by this process, there is nothing to show whether the sender's hand was correct, or the receiver's eye undeceived, or the copyist's ear unerring, or, if a difference arises between them, the evidence may be equally in favor of each. To ascertain who is in fault is difficult, the instrument being visual or non-recording. This primitive method is now generally used in Great Britain. On the Continent, however, Morse's self-recording instrument is generally used.

The main features of this instrument consist in making a temporary magnet of a piece of soft iron, by passing a current of electricity through it, attracting an armature attached to one end of a lever, thus pressing a stile upon the other end against a strip of paper moved by clockwork at an uniform rate of speed. By this means the manipulator is enabled to record, both at the home and distant stations, symbols, consisting of short and long lines, with blank spaces. These hieroglyphics are transmitted by the receiving clerk, written out, and enclosed to the person for whom the message is intended.

The Morse instrument is used upon many of the American lines. A roman type-printing instrument, the invention of Mr. House, is also used to some extent in America. It is more rapid than the Morse, printing accurately twelve to fifteen hundred words an hour in ordinary working, and is therefore approved upon lines which have a great amount of business.

It is, however, more complicated than the Morse or the Hughes instruments, and requires an immense battery power to work it, so much so that it is not practicable, upon the best air or overground lines, for

circuits of more than 150 miles, while upon underground or submarine wires it has not, and I believe cannot, be worked thirty miles.

The House instrument is based upon the step-by-step motion, or that the number of waves sent shall determine the letter to be printed. The type is made to revolve by means of a treadle, but is checked at each letter by an escapement, which only allows it to move one letter at a time.

This escapement is moved by the flow of compressed air upon alternate heads of a plunger. The passage of air is governed by a valve attached to the armature of the axial electro-magnet, each wave of the voltaic current causing an action of the magnet, and consequently of the plunger and escapement, by the air force.

Compressed air is used to get greater power on the escapement, as the electric current would be too weak to move the escapement, whilst sufficient to move the armatures and valve. In the transmission of a message, the operator sending it, checks a circuit breaker at a certain number of waves, and this stops the type-wheel of the distant instrument by means of the escapement; and, as soon as stopped, a press is unlocked, which imprints the letter.

This unlocking of the press is very ingenious, its action depending on the motion of the type-wheel. The main constituents of this instrument are the transmitting apparatus, a compound axial magnet, and a manual power by which the instruments are kept in motion.

The instruments thus concisely described, as well as all minor ones hitherto worked with one wire, require an average of five or more electrical impulses or waves, or the time equal to this number, to transmit one letter.

The recording in roman type each letter of a message by a single wave, upon one wire, is the triumph of the Hughes system. To accomplish it, several requisites are necessary, which it may be proper to state, and then proceed to show how they are each obtained, and, united in one harmonious whole, producing that life-like automaton present to demonstrate before you what is advanced, and practically speak for itself in plain English.

These requisites are, first, synchronous motion; secondly, an electro-magnet, by which the timing of the electrical wave may be accurately measured; thirdly, a writing apparatus, by which the message may be correctly, rapidly, and easily transmitted; fourthly, a printing apparatus, by which the operator can record the message unerringly upon his own instrument, as well as upon the one at the distant station.

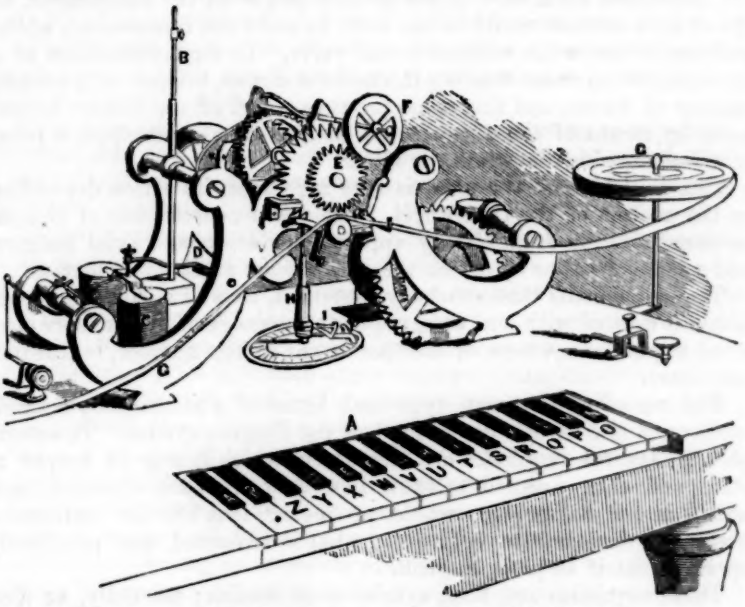
Many inventors have attempted to make an instrument, by which a letter could be sent by one wave, but without success. One reason was, that they had no governor of sufficient velocity and accuracy, to produce rapid synchronous motion.

Prof. Hughes applies a vibrating spring to govern his instrument. It is a well known law that a certain number of vibrations produces a certain musical tone; therefore, if two or more springs have the same tone they must necessarily have a similar number of vibrations in the

same time. The instruments are kept in motion by a weight acting upon a train of wheels, the spring governor acting upon them by means of an ordinary escapement.

These vibrations may succeed each other with any degree of rapidity required. They are regulated by a small weight attached to the spring, and raised or lowered until the number of vibrations or desired tone is produced. This can be done easily and quickly, although the instruments may be any number of miles apart—say between London and Paris, or Ireland and America.

The type-wheels of the instruments now exhibited, revolve at the rate of one hundred and twenty revolutions per minute, and the governor makes fifty-six vibrations for each revolution of the wheel.



A. Key Board.	D. Detent.	G. Paper Printed upon.
B. Vibrating Spring.	E. Type-wheel.	H. Revolving Shaft.
C. Electro-magnet.	F. Ink Roller.	I. Revolving Arm or Circuit Closer.

The Magnet.—The Hughes magnet is of peculiar construction. A permanent magnet polarizes the cores of an electro-magnet, and holds an armature in contact with its poles. A spring is attached to this armature, and so adjusted as to exert a counteracting power a little weaker than the force of the magnetic attraction. If, therefore, the magnetic force be diminished, the armature is removed from the poles of the magnet by the force of the spring.

The arrangement is such that the current of electricity passing through the coil when the circuit is completed, induces an opposite magnetism to that of the permanent magnet. The electrical force,

therefore, which works this instrument, need not be sufficient to induce such a degree of magnetism, as to render the core sufficiently magnetic to attract an armature to its poles—the practice in all other recording telegraphs. For instance, if the cores of the electro-magnet, polarized by the permanent magnet, have a holding force upon the armature of ten, and the spring attached to the armature be adjusted with an opposing force of nine, then a current of one reducing the force of the electro-magnet, would cause the spring to rise with the force of nine.

This arrangement can in practice be so nicely adjusted as to work with a very feeble current, and accurately measure the timing of the electrical wave. The armature being mechanically restored to contact with the poles, has the advantage of being acted upon by the maximum power of the electro-magnet, instead of a power lessened by more than the square of the distance the armature has to be attracted, as is the case in the relay magnets used in connexion with the Morse and other systems.

Transmitting Apparatus.—The letters of the alphabet, as well as a dot and a blank, are marked on twenty-eight keys, arranged like those of a piano, save that they are alternately black and white. These keys correspond to twenty-eight holes arranged in a circle on the horizontal floor or table of the instrument, immediately in front of the keys. Each key is connected by a lever with a little steel knob, which, when the key is pressed down by the finger, rises up through one of the holes. An arm, connected with a vertical shaft, sweeps over the twenty-eight holes. If a key marked with a particular letter be touched, the knob corresponding with this letter rises, the revolving arm passes over it, and for the instant closes the circuit, and allows an electrical impulse to be transmitted. This impulse, by arrangements which will be described in the printing apparatus, causes the particular letter to be recorded on a slip of paper in printer's ink. The instant the arm passes over the little raised knob the circuit is broken, and if the finger were held a hundredth part of a minute on the key, the hand would pass again over the knob, and the letter would be repeated. To prevent this, the hand carries, after the portion of it which rides over the knob and completes the metallic contact which closes the electrical circuit, a little inclined plane, which throws the knob out of its position, so that the hand cannot pass over it on any future revolution after the first contact. This arrangement is rendered necessary to prevent the repetition of letters, on account of the extreme rapidity of the revolving arm and recording apparatus.

Printing Apparatus.—A shaft, which revolves seven times faster than the type-wheel, has a fly wheel upon it to overcome the inertia of a small shaft which moves the printing press. This shaft is locked to the fly-wheel shaft by means of a clutch, which rests upon a small inclined plane. Whenever this clutch is kept upon the inclined plane, by means of a detent, the fly-wheel shaft revolves independently of the small printing shaft; but as soon as the detent is moved by the

action of the armature of the electro-magnet, the clutch locks both shafts together, and the small shaft is made to revolve one revolution, when the clutch again rests upon the inclined plane, which lifts it off the fly-wheel shaft. A cam is attached to one end of this shaft, which lifts the press and the paper upon which the message is to be printed against the type wheel. The time of the locking of the shafts depends upon the arrival of the electrical wave, and thus, with two instruments in perfect harmony, the operator has the printing apparatus of the distant instrument as completely under his direction as the one before him. But to correct any minute variation in time between the instruments in circuit, there is a corrector, or wheel, attached to this shaft, with hook-shaped teeth, which mesh into corresponding cavities in the type-wheel. The latter being loose upon the shaft, or only held by friction, is removed backwards or forwards by the corrector to exactly the same position as the type-wheel on the instrument from which the message is being sent. This corection takes place in the act of printing every letter. There is also upon this shaft a cam, so arranged that, the moment the armature falls off the electro-magnet and opens the detent, it forces the detent up, and restores the armature to its original position upon the poles of the magnet.

Another new feature in this instrument, is its power of cutting off at will all offices except the one to which it is desired to communicate. This is accomplished by a flanch on the type-wheel—this flanch having a space cut out opposite a certain letter, and each office having the flanch cut out at different letters from each other. A bolt is made to slide through the space, and moved through by the action of the instrument. If this bolt is sent through at the moment the space is opposite, it permits the instrument to run, if not it goes against the flanch and locks the type-wheel.

The operator, knowing at what letter a certain instrument will be unlocked, touches that key. This allows the instrument he wishes to communicate with to run; and he can send the message to that one, the other offices being unable to get it, as they would be locked, and could not bring their instruments into unison with the one sending the despatch. Thus, it is absolutely secret in its transmission, and if necessary, any one could send his own message, as it is only necessary, to ensure its safe arrival, to touch the right keys, which are all lettered.

The electrical circuits are extremely simple. The earth-wire connects with the steel pins or knobs on the keys of the transmitting apparatus, and from the revolving arm through the electro-magnet, and thence through the line and distant magnet to the earth. Reversed currents are not necessary, except on long submarine wires. There may be as many instruments in circuit as may be desired. The European news, consisting of about 3000 words, by the arrival of each Transatlantic steamer, is transmitted by this instrument from Boston to New York, a circuit of about 300 miles, at the rate of 2000 to 2500 unabbreviated words an hour. There are 25 stations on the cir cuit which receive copies of the news, all of which are printed in plain Roman type by the Boston operator, all the instruments receiving the

message at the same time, the receiving clerks at each station having simply to hand the copy as it arrives to the party entitled to receive it.

The mode of operating with this instrument is extremely simple, and easily acquired. The office desiring to transmit a message calls the station by touching the keys in a pre-arranged order, the distant office at once returns the signal "O K.," or all right. The manipulator then commences the message, first striking the zero key to start the distant type-wheel in unison with his own. If the message is received correctly he is allowed to finish, and then the operator at the distant office gives the return signal of all right; if there is a mistake the receiving office touches his key board, which throws extra letters to the transmitting station, and he then commences again from the point where he made a mistake. There can be no mistake, however, if the operator touches the right key, and manipulators become so expert that they seldom touch the wrong one; if they do, the error is shown by the copy of the message on their own instrument, and immediately corrected.

If I have succeeded in conveying a clear and intelligible impression of the principle of the Hughes system, it may be proper to invite your attention to what appear to me to be natural deductions.

Accuracy is secured by unerring mechanical laws, and not by the skill of the operator, as in the needle or Morse systems. Not only this, but in all other systems, if one of the symbols be missing, another letter is formed by the remaining symbols. *Rapidity* is secured by reducing the labor to its minimum. A single touch of the key prints the letter, instead of three or four vibrations of a needle, or a similar number of motions of a key, as in the formation of symbols to represent letters. Accuracy and rapidity being thus secured, ease and simplicity of manipulation must of necessity follow, and consequently the young operator readily acquires his or her education. The instrument however, is specially adapted to females.

The one-wave system is specially important on long submarine circuits, where electrical impulses are limited, one wave being sufficient for a letter instead of five. Great difficulty has been experienced on long cables by the variation of time in the transit of the wave. By this correct timing instrument, simple and perfect compensation is mechanically attained for any length of wire or extent of variation. The sensitiveness of the magnet also enables this instrument to record more waves upon a long circuit than any I have yet met with. The rapidity of an instrument, however, does not consist only in the fact of its extreme sensitiveness, but also in its power to free itself from the influence of a current so soon as the effect of the current has caused the instrument to record the signal or letter sent. This property, attained by the electrical and mechanical combination of scientific laws, embodied in the design and construction of the instrument, and demonstrated by the results produced, must in time remove all doubt of its superiority, while its English tongue represented in plain printed Roman characters, will tend to make it the favorite of the Anglo-Saxon race.

(To be Continued.)

On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure rapid and certain communication.* By S. ALFRED VARLEY, Assoc. Inst. C. E.

Since the practical realization of the electric telegraph, several valuable communications connected with the subject have from time to time been laid before this Society.

These papers have generally treated of the mechanical details and improvements in the apparatus which have been designed and brought forward by various patentees and inventors.

In the course of the discussions which have taken place, it has appeared to me that the principles of the science of electricity have not always been sufficiently appreciated, and the practical value of many of the beautiful contrivances not elicited, from not having determined clearly the principles of the science which are involved in telegraphing, and, consequently, the properties which are essential, and must be possessed by all apparatus, to give them a practical value.

This feeling has led me to think that a paper on the Theory of Electricity, keeping always in view its bearing on electric telegraphy, and which should rather treat of the principles of telegraphic apparatus than confine itself to special contrivances, would be subservient to the progress of the object we have in view; for it must not be forgotten that although the world is always indebted to the practical man for the application of science to commercial purposes, and, in the case of the electric telegraph, it is even questionable whether we are not indebted for its very rapid extension in part to the inability of the projectors to appreciate difficulties which the philosopher foreseeing would have hesitated at—or, perhaps, to the greater faith possessed by the practical man in the ability of science to overcome whatever difficulties may present themselves; yet it must not be forgotten that, in the principles of a science, the philosopher is often far ahead of the practical man, and the latter at times comes suddenly and unprepared upon difficulties, which, had he understood correctly the principles long before developed by science, he would have been led to expect as natural consequences. As an example of this, I would mention the case of electric induction, which manifested itself so strikingly when the system of subterranean circuits was considerably extended on the introduction and successful manipulation of gutta-percha.

This phenomenon was unexpected and unlooked for by many, though not all, of our practical electricians; and we find it referred to, and regarded at the present time, as a new fact which the electric telegraph has brought to light, and not one to have been anticipated; yet the laws of induction were beautifully and clearly developed by Dr. Faraday, as far back as 1838; and, when called upon to examine this new telegraphic difficulty, we find him alluding to it in an instructive lecture, delivered before the members of the Royal Institution, as a

* From the Jour. of the Society of Arts, No. 332.

strong confirmation of the truthfulness of views he had put forth as far back as 1838. I would direct attention particularly to this, because I cannot help feeling that our progress is too often obtained by a laborious perseverance in almost empyrical experiments, until, by the laws of chance, a successful result is hit upon, instead of endeavoring, in the first place, to develop a guiding principle, and referring back to it, as each step forward is made, to test both the truth of the principles laid down, and the correctness of the conclusions arrived at. Were this done, experience would not be paid for so dearly; and the commercial application of a science would not be almost paralyzed, as it sometimes is on its first introduction, by the costly series of experiments which have to be gone through before correct principles of working are established.

During March, 1858, the subject of telegraphic cables was very fully entered into by the Institution of Civil Engineers. Finding at that time there were no papers on the electrical portion before the Institution, and feeling that the subject could not be fully considered without the electrical part being entertained, I was induced at the eleventh hour to attempt to supply the deficiency. Some explanation is perhaps therefore due from me for bringing forward, so shortly afterwards, another paper on almost the same subject. Owing to the large number of evenings which had already been occupied in the consideration of the mechanical portion of the problem, and the late hour at which my paper was submitted, it was only read in abstract, and no discussion taken upon it. The views, too, I then brought forward were opposed to some which have lately been laid very prominently before the public, and no opportunity given to contradict them, or to verify their correctness; and as I am convinced that so far from the subject being exhausted, its importance is only now beginning to be appreciated, the opportunity having been offered to me to bring the matter before the Society of Arts I determined to avail myself of it.

The complete way in which the subject was taken up by the Institution of Civil Engineers is, however, I am glad to say, already bearing fruit; and since the publication of the papers by the Institution, several valuable discussions have taken place in the scientific journals, and in some of the remarks I have to lay before you to-night, I find, to a certain extent, I have been anticipated.

The generally recognised theory of electricity, as I understand it, supposes all bodies in their normal condition to have two powers or forces resident in them directly opposite in their character, being exactly balanced; in bodies in their natural state these forces are completely neutralized and rendered inactive, producing the ordinary condition of matter.

To these powers the name of electricities has been given, and although we are still as ignorant at the present day as the ancients themselves with regard to what electricity actually is, yet the fact of the existence of the electric telegraph is a proof of the progress which has been made in a knowledge of the laws, at least, which govern electric phenomena.

In the year 1838, Dr. Faraday clearly developed the principles of induction and conduction, since which time no further progress has been made in the fundamental truths of the science, though much has been done to confirm their correctness and to develop their consequences.

In the *Philosophical Transactions* for 1838, will be found Dr. Faraday's views on the subject of induction and conduction; and these, to my mind, so clearly explain all electric phenomena, that it will be as well at once to refer to them before proceeding further. After giving reasons for his belief in the identity of induction and conduction, he says, "all these considerations impress my mind strongly with the conviction that insulation and ordinary conduction cannot be properly separated when we are examining into their nature, that is, into the general law or laws under which their phenomena are produced. They appear to me to consist in an action of contiguous particles dependent on the forces developed in electrical excitement; these forces bring the particles into a state of tension or polarity, which constitutes both induction and insulation, and, being in this state, the continuous particles have a power or capability of communicating their forces one to the other, by which they are lowered, and discharge occurs. Every body appears to discharge, but the possession of this capability in a greater or smaller degree in different bodies, makes them better or worse conductors, worse or better insulators, and both induction and conduction appear to be the same in their principle and action, except that in the latter an effect common to both is raised to the highest degree; whereas in the former it occurs in the best cases in only an almost insensible quantity."

In part the 2d of the *Philosophical Transactions* of the same date will be found a summary of Dr. Faraday's views, which I will also quote:—

"1st. The theory assumes that all the particles, whether of insulating or conducting matter, are, as wholes, conductors.

"2d. That, not being polar in their normal state, they can become so by the influence of neighboring charged particles, the polar state being developed at the instant, exactly as in an insulated conducting mass consisting of many particles.

"3d. That the particles when polarized are in a forced state, and tend to return to their normal or natural condition.

"4th. That being, as wholes, conductors, they can readily be charged either bodily or polarly.

"5th. That particles which, being contiguous, are in the line of inductive action, can communicate or transfer their polar forces one to another more or less readily.

"6th. That those doing so less readily require the polar forces to be raised to a higher degree before this transference or communication takes place.

"7th. That the ready communication of forces between contiguous particles constitutes conduction, and the difficult communication insulation; conductors and insulators being bodies whose particles naturally possess the property of communicating their forces easily, or

with difficulty, and bodies having these differences as they have differences of any other natural property.

"8th. That ordinary induction is the effect resulting from the action of matter charged with excited or free electricity upon insulating matter, tending to produce in it an equal amount of the contrary state.

"9th. That it can do this only by polarizing the particles contiguous to it, which perform the same office to the next, and these again to those beyond; and that thus the action is propagated from the excited body to the next conducting mass, and these render the contrary force evident in consequence of the effect of communication which supervenes in the conducting mass upon the polarization of the particles of that body.

"10th. That, therefore, induction can only take place through insulators; that induction is insulation, it being the necessary state of the particles, and the mode in which the influence of electrical forces is transferred or transmitted across such insulating media."

To determine for myself the law which induction obeys, in conjunction with my brother, Mr. C. John Varley, I have tried some experiments.

The principle upon which these were based was that of the dual character of electricity, and the fact established by Dr. Faraday, that all statical charge is sustained solely and entirely by induction.

In bodies in their normal condition, the opposite forces or electricities being balanced and united, no attraction for neighboring particles exists, but when these forces are separated, as in the case of a Leyden jar, the attraction which a given quantity of electricity exerts for the similar amount of negative on the opposite coating, will be less in proportion to some law as the thickness of the dielectric intervening is increased.

It was therefore assumed that the amount of free attraction under these circumstances, or more correctly the amount of induction which would be thrown upon neighboring bodies, would increase inversely as the attraction between the opposite coatings diminished.

The apparatus made use of was constituted in the following way:—A glass pillar, varnished, for better insulation, was mounted upon a board. On the top of this a brass plate was attached, and upon this plate the dielectric to be examined was laid. Over the dielectric another brass plate was then placed.

A Leyden arrangement was thus constructed, the upper and lower brass plates representing the inner and outer coatings of an ordinary Leyden jar.

A brass ball, suspended from a balance which had an adjusting arrangement, so that it could be raised or lowered, hung over the upper metal plate at a short distance from it.

The *modus operandi* was as follows:—The upper brass plate was connected to the earth, and a series of sparks, through the medium of a sliding rod kept at a fixed distance from the prime conductors of a frictional machine, thrown into the lower brass plate of the Leyden arrangements, or the prime conductor was kept fully charged, and a

carrier ball attached to a long glass rod was made use of to measure out definite quantities of electricity.

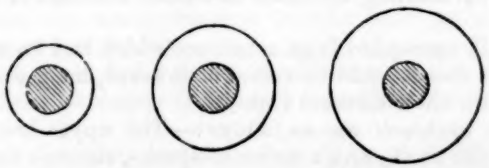
The room in which the experiments were performed, was heated with a stove, and the dryness of the atmosphere indicated by a hygrometer, so that the insulation might be as perfect as possible. When a certain number of sparks had been thrown into the lower brass plate, the upper brass plate was disconnected from the earth, and the lower one attached to the balance, and if the tension of the charge was sufficient, the brass ball suspended from the balance was attracted down, and discharge ensued. The experiment was repeated again and again, and the number of sparks requisite to just attract the ball down, noted.

Glass plates were the dielectric employed, and the experiment was tried first with one plate, then with two, and then with three plates of glass between the upper and lower brass plates, the brass ball suspended from the balance being kept always at a certain fixed distance from the upper brass plate.

The results obtained from a numerous series of experiments were—that when two plates of glass were placed between the brass plates, only half the number of sparks which were required to raise the tension of charge sufficiently to cause discharge when one plate of glass separated the brass plates was requisite, and when three plates of glass divided the upper and lower brass plates, then a third of the number of sparks raised the charge to the same degree of tension, showing that through flat plates of glass, induction decreases in the inverse proportion to the thickness of the dielectric, that is to say, if the induction through one be 12, through 2 it will be 6, through 3—4, and so on.

In the case of a gutta-percha covered wire, it was anticipated that as when the thickness of the gutta-percha is increased, the outer surface increases at the same time, the decrease of induction consequent on the increased thickness of the insulating material would not be inversely proportionate to the depths of the gutta-percha, but would follow some other law. To put this to the test, a series of Leyden arrangements were constructed in the following way: three pieces of tube, of half an inch internal diameter, and 2 feet 6 inches long, were placed in the centre of tubes of 2 feet long, the internal diameters of which were 1 inch, 1½ inches, and 2 inches, and the space between the inner and outer tubes filled with melted resin. (Figs. 1, 2, 3.)

Fig. 1. Fig. 2. Fig. 3.



By this means three Leyden arrangements, with a uniform internal surface, but whose insulating material varied in thickness in the pro-

portion of 1, 2, and 3, were constructed, and the same process as that already described with the flat plates was repeated.

The results obtained are shown in the annexed table:

Diameter of Inner Tube.	Thickness of Insulation.	Diameter of Outer Tube.	Inductive Force.
10	5	20	22
10	10	30	15·5
10	15	40	11·5

These results were very constant, but as resin was the only dielectric employed, the experiment requires repeating with other dielectrics, for there is reason to believe that with glass at least the decrease in induction consequent on an increased thickness of the dielectric would be somewhat greater than that indicated in the above table.

The reasons for this belief are the following:—When a galvanic battery is connected with the inner and outer coatings of a Leyden arrangement, induction will take place through the dielectric, and if the surfaces of the two coatings are equal, then the force will be equally divided over them; that is to say, if the battery force be 100, the tension of the charge on the one coating will be 50, and that on the other will be 50 also, =100.

Let the surface of the outer coating be supposed to be infinite in extent, then the tension of the charge on the inner coating will be almost nil. An example of this we have when the earth represents one of the coatings of a Leyden arrangement; and this is the case in the prime conductor of a frictional machine, and also in the suspended wire of a telegraphic circuit; in these two examples the prime conductor of the machine and the wire of the telegraphic circuit represent the one coating, the air the dielectric, and the earth the other coating.

Now consider a case where the outer surface is double that of the inner one, the tension of the charge on the inner coating will then be double that of the *outer;* an example of this we have in the above table, where the inner surface is 10, the thickness of the insulation 5, which may here be regarded as unity, and the outer surface 20—the battery force being 100. Divide this into three parts, and we get $33\frac{1}{3}$. Give two parts for the tension of the charge on the inner coating, and one part for the tension of the charge on the outer coating, then we shall have for the tension of the inner surface, $66\frac{2}{3}$; for the outer surface, $33\frac{1}{3}$, =100 when united.

Now, consider the third example in the above table. Inner surface 10, thickness of insulation 15, outer surface 40, or quadruple that of inner surface. In this case the tension of charge on the inner surface will be four times that of the charge on the outer surface. In other words, the tension of the charge on the smaller surface will be 80, and that of the outer surface 20, the united tensions equaling 100; but the thickness of the insulation is 15, or three times that of the first example; and it has been shown that induction decreases in the in-

verse proportion to the thickness of the insulating material; we shall, therefore, have to divide by 3, and this will give 26·6 for the tension of the charge on the inner surface.

In the first example it has been shown that if the force be 100, the tension of the charge on the inner surface will be 66⅔, which, to avoid fractions, we may regard as 67. In the actual experiment the inductive force measured was 22; 67, therefore, represents 22, and as 67 is to 22 so should 26·6 be to the amount of force which would be expected to be obtained in the last example; this, when calculated by a simple Rule of Three sum, gives 8·8 for the amount of inductive force. In the actual experiment the force obtained was 11·5, a result, therefore, sufficiently near to warrant further investigation, to ascertain whether the law which would seem to be indicated is correct, and whether it holds good with any other dielectric, such as glass, in which case the cause of the discrepancy, when resin is the dielectric employed, should be sought after.

I now proceed to conduction.

The law which governs the conduction of electricity has been very accurately ascertained, and would seem to follow the same law as induction, that is to say, if the sectional area be uniform throughout, the resistance which a conductor will oppose to the passage of a current will be directly relative to its length; or, the length of the conductor being determined, the resistance will be relative to its sectional area. In other words, a wire one mile long will oppose half the resistance of that which will be opposed by a similar wire two miles long; and two wires, each two miles long, placed side by side, which is the same thing as one of twice the sectional area, will oppose exactly the same resistance as a single wire one mile long.

The next thing to be considered is the part which the quantity and intensity of electric currents play in electric phenomena.

The amount of force developed by an electric current, whether it be the deflexion of a needle, the attraction of an armature in an electromagnet, or the decomposition of water, is always relative to the dynamic quantity flowing.

This fact has been well established, and the difference between quantity and intensity accurately defined; yet still, in practice, there is a want of a clear comprehension of the relationship of those terms.

Let a battery—say of ten pairs of elements, with ten inches of surface in each cell—be joined through a circuit perfectly insulated, and opposing very great resistance to the passage of the current, and the amount of force, or in other words, the dynamic quantity of electricity flowing, be weighed off by a magnetometer, and noted down. If now this battery be disconnected, and another of the same number of elements, but with twice the surface, be connected in its place, practically no more will be found to be flowing through the circuit than in the former case, the resistance which the wire opposes measuring out the quantity passing somewhat in the same way as the height of the column, and not the quantity of water in a cistern, regulates the rate at which it flows from an orifice inserted in it.

Let the series be increased, and more will be urged through; and, if the number of cells be sufficiently numerous for practical purposes, the same dynamic quantity as a single cell would generate through a circuit of no resistance, will be found to be flowing.

In theory this point can only be approached, for the resistance of the wire can never be completely overcome. In theory, also, when the number of elements is not increased, the larger the surface the greater will be the dynamic quantity flowing, for the tension of the current is lowered in proportion to the amount of electricity flowing out of the battery; and, when drawing from a larger reservoir, which batteries of greater surface may be compared to, this same amount will not lower so much the general tension; consequently, there will be more intensity to urge the current through. But to return to practice. If the number of cells has been sufficiently extended so as to generate the same dynamic quantity as a single cell does through a circuit of nominally no resistance, a further addition to the series will not be attended with any beneficial effect, for there is already power enough to urge through all the electricity the battery is capable of generating; and the force developed is directly relative to the dynamic quantity flowing. Tension is only the medium by means of which this dynamic quantity is forced through the circuit.

It will be as well, perhaps, to define more precisely what is wished to be understood by the term resistance. When it is said that one circuit opposes twice the resistance of another, it is meant that the same tension of current will force half the dynamic quantity only through this circuit that it would through one opposing half the resistance; it follows that a given length of wire opposes the same resistance to half the dynamic quantity of electricity that half this length of wire does to double the dynamic quantity, and hence all circuits oppose to an infinitely small quantity of electricity an infinitely small amount of resistance.

The way in which quantity and intensity affect practical telegraphing has next to be considered, and whether there be any advantage in employing comparatively large over smaller dynamic quantities of electricity.

It may be generally stated that when the insulation is very perfect there is no great difficulty in working with minimum quantities; but when the insulation is imperfect, larger dynamic quantities hold out a better prospect of working through.

When a current is flowing through a circuit which offers, practically speaking, no resistance, let the cells of the battery be ever so numerous, it will possess no intensity worth noticing, for, as there is no resistance opposed to the force resident in the battery, the intensity is not brought into play. It is something like a powerful engine raising a light weight, the force is latent, but not brought into action.

Let the battery, however, be connected through a circuit opposing considerable resistance; its intensity will then be developed.

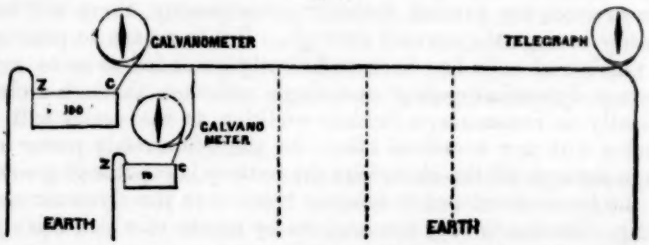
Let the diagram (fig. 4,) represent a circuit which fulfills these conditions, one end of the wire dipping into the earth in the usual way, and the other connected with the copper pole of a battery composed

of a numerous series of elements possessing very little surface, and, consequently, capable of generating only a small dynamic quantity of electricity, and let the circuit be completed by connecting the zinc pole to the earth.

The current will flow from the copper pole through the wire, thence to the earth, and back to the battery, and its working intensity will be dependent on the resistance which the circuit opposes, and can be measured in the following manner:—

Let another battery, but with a much smaller number of elements, be connected side by side with the larger battery to this wire, the zinc

Fig. 4.



pole being connected to the earth and the copper to the wire, and introduce galvano-meters in the circuit, between the large battery and the wire and between the small battery and the wire, so as to indicate the direction in which the currents are flowing.

Both batteries will desire to send a current through the circuit in the same way, but should the small battery oppose much less resistance to the passage of a current through itself than is opposed by the long wire, then the greater quantity of electricity generated by the large battery will pass that way in preference to through the wire, and paralyze the action of the smaller battery; but if cell after cell be added to this little battery, when its intensity becomes greater than the resistance of the wire, a current will flow from it also in the same direction as that from the large battery through the wire, and the number of cells requisite just to do this will be an exact measure of the working intensity of the current.

Let the case now be considered where the insulation is not perfect; if there be sufficient leakage to let the small dynamic quantity, which the battery can only generate, escape on the road, no appreciable amount will reach the further end, the tension of the current will be lowered, and a less number of cells in the little battery will now be found to balance it.

Adding to the number of these small pairs of elements will not give any appreciable assistance, but let the surface in each of the cells of the larger battery be increased so that a greater quantity may be generated than can escape through the leaks, represented in the diagram by the dotted lines, an appreciable amount will then reach the further extremity, and the telegraph instrument be rendered active. . In such a case as this, adding quantity will raise the working intensity of the

current, whilst increasing the intensity of the battery alone will scarcely affect it.

In some experiments tried by my brother, Mr. Cromwell Varley and myself, on long leaky circuits, increasing the surface of the batteries alone, without adding to the series, raised the deflexion on the galvanometer from 22° to 53°; and the last intelligible words uttered by the Atlantic cable, "Daniells are now in circuit," is a further testimony of the correctness of what has just been advanced.

(To be Continued.)

For the Journal of the Franklin Institute.

Fog Signals by Sounds.

Musical phrases are used in armies to direct the movements of men, but no advantage is taken of them to convey information beneficial to vessels navigating in a fog or on dark nights. We have steam whistles, bells, gongs, and horns, to make unmeaning noises. Why cannot a regular system of phrases or sounds be introduced showing which way a vessel is heading to avoid collision, &c.? Only two musical intervals would be required, say an octave or a fifth, to communicate any information wanted. When it has been suggested, the reply has been, "we do not understand music." A knowledge of music is not necessary; when we hear the sound of the bird whistling "Bob White," we know what bird it is, and this interval, alone, introduced on board of our river steamers would be invaluable; for "Bob White" being the upward bound craft, and "White Bob," or the descending interval, the downward, they could port their helms or stop their engines, as circumstances required. E. B.

Brooklyn, April 14, 1859.

The suggestion of our correspondent, simple as it is, or rather on account of its very simplicity, is well worthy of attention. It is not necessary to insist on the necessity of some kind of signals to avoid collisions, and the constantly recurring record of such accidents in our newspapers shows pretty conclusively that those at present in use are insufficient. In fact, nothing but absolute necessity could justify the apparent absurdity of having recourse to sight-signals to avoid accidents arising from the want of power to see. But the circumstances which deprive us of the use of our eyes, exert no power over our ears; and it is very easy to arrange signals by sound which may tell all that we want to know. The direction of the sound can be made out with sufficient ease and accuracy to prevent running into its origin; and the properties of sound, the differences in tone, in duration, and in loudness (even those of quality might, if necessary, be used), will give us a very large number of signals capable of being heard at great distances, and of being distinguished by the dullest apprehensions. The two signals suggested by our correspondent, for instance, consisting of a low short sound, followed by a high and long one, and the reverse, are sufficient to indicate the direction in which a vessel is

heading—and as the direction in which she lies at the moment is known, these are all that are in most cases wanted.

If any one doubt the feasibility of such uses, let him take one of the small steamers that run along the coast of Maine, between the islands and the main—a coast infested in the summer by almost continued fog—and see how rapidly and accurately the position of land or vessels is determined by the echo of the steam whistle; and we do not doubt that he will come back convinced of the possibility and utility of such signals. ED.

For the Journal of the Franklin Institute.

Particulars of the Steamboat John Brooks.

Hull built by John Englis. Machinery by Allaire Works, New York. Intended service, New York to Bridgeport, Connecticut.

HULL.—

Length on deck, from fore part of stem to after part of stern post, above the spar deck,	250 feet.
Breadth of beam at midship section,	34 "
Floor timbers—molded, 14 inches—sided, 11 inches.	
Frames—apart at centres, 26 inches.	
Depth of hold,	11 "
" to spar deck,	11 "
Draft of water at load line,	7 "
" below pressure and revolutions,	7 "
Tonnage,	900.

ENGINE.—One—Vertical beam.

Diameter of cylinder,	56 inches.
Length of stroke,	12 feet.
Maximum pressure of steam in pounds,	40.
Cut-off,	8 "
Maximum revolutions per minute,	22.

BOILERS.—Two—Return flues.

Length of boilers,	26 feet.
Breadth "	10 " 6 inches.
Number of furnaces,	3 in each.
Breadth "	43 × 36 inches.
Length of grate bars,	7 feet.
Number of flues,	24.
Internal diameter of flues,	21, 14 and 13 "
Diameter of smoke pipe,	4 feet 6 "
Height "	40 "
Description of coal,	Anthracite.

PADDLE WHEELS.—

Diameter,	34 feet.
Depth of blades,	22 inches.
Number "	28.

Bronze of Aluminium.—Letter of M. Christofle to M. Dumas.

We have applied the aluminium-bronze to two uses for which its qualities of hardness and tenacity appear usefully applicable, and success has answered our attempt. The first is the manufacture in this

bronze of axle-bearings, and rubbing surfaces for machines. We give as examples:—

First, An axle-box which was placed on a polishing lathe making 2200 turns per minute; it lasted for nearly eighteen months; other boxes in the same condition do not last over three months.

Second, A carriage for a circular saw, making 240 turns per minute, which has lasted for a year without an apparent trace of wear; the carriages in common bronze do not last more than four months.

The second application is the employment of this bronze in the manufacture of guns of all kinds. We made a pistol-barrel, which, after having been tried at Paris, was afterwards at the Exhibition at Dijon. It underwent the tests in presence of the jury, and answered perfectly our expectations. We are aware that these experiments cannot be conclusive as to its application for artillery; but the comparative experiments which we have made with this metal, bronze, iron, and steel, have shown the immense superiority over those different metals.

The bars may be worked hot as easily as the best quality of steel.—*Academy of Sciences of Paris.*

(The bronze here spoken of, is formed of 90 or 95 parts of copper, and 10 or 15 parts of aluminium. ED. JOURN. F. I.)

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*Destructive Effects of Red Lead upon Iron.**

Mr. Robert Lamont, who was, a few months back, requested by the managers of one of the largest steam packet companies in the kingdom to make a report on the merits of certain compositions used to a large extent in Liverpool for the preservation of iron ships, and to prevent fouling on the bottoms of such vessels, has come to the conclusion, so far as regards the use of red lead, or paints containing lead, quite at variance with the popular notion upon the subject, by declaring the use of that pigment for coating iron vessels to be most pernicious. And in this hypothesis he is confirmed by the opinion of Mr. Nathan Mercer, F. C. S., who, after inspecting the iron ship *William Fairburn*, the plates of which were coated with red lead prior to her late voyage to Calcutta, observes that the extent to which the iron had been corroded could not fail to have attracted the attention of the most superficial observer. On a close inspection he found the red lead coating covered with blisters, from each of which, on being opened, a clear fluid escaped, and left exposed on the surface of the iron a number of brilliantly shining crystals of metallic lead. Mr. Mercer says each blister is, in fact, a galvanic battery in miniature, and that, as wherever there is electrical there must be also chemical action, the corrosion is easily accounted for. This action, he says, will continue as long as any red lead remains, and is necessarily at the expense of the iron. He also points out that the "sweat," so well known to every person interested in iron ships, is not, as is generally supposed, salt water, but a solution of chloride of iron manufactured in the blisters. Mr. Mercer considers this sweating is due, in a great degree, to the

* From Herapath's Journal, No. 1037.

use of red lead paint in immediate contact with iron; and he recommends, therefore, that it should never be used as a coating for seagoing vessels, unless special precautions are taken to prevent its coming into direct contact with the iron.—*Liverpool Albion.*

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*Water Boiled without Fuel.**

It had always been considered that water presented an exception to the rule observed to hold in other bodies—namely, that their temperature could be raised by friction or percussion, until Mr. Joule showed that water manifested a sensible rise of temperature by a brisk agitation continued for some time. His range of temperature did not, however, we believe, exceed 2° Fahr. George Rennie, F.R.S., so well known in the engineering and scientific world by a pamphlet before us, has so improved on the experiments of Mr. Joule and others, as to have succeeded in raising the temperature of water by churning up to the boiling point 212° Fahr.

* From Herapth's Journal, No. 1022.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 16, 1859.

John C. Cresson, President, in the chair.

John F. Frazer, Treasurer,
Isaac B. Garrigues, Recording Secretary, } Present.

The minutes of the last meeting were read and approved.

Letters were read from the Superintendent of the Geological Survey of India, and the Geological Museum, Calcutta, India; the Regents of the University of the State of New York, Albany, N. Y.; the Union College, Schenectady, New York; the Massachusetts Charitable Mechanics' Association, Boston, Mass., and the University of Michigan, Ann Arbor, Michigan.

Donations to the Library were received from the Royal Society, and the Chemical Society, London; the Government of India, Calcutta, India; the Austrian Engineers' Association, Vienna, Austria; L. A. Huguet-Latour, Esq., Montreal, Canada; the State University of Michigan, Ann Arbor, Michigan; the Proprietors of Locks and Canals on the Merrimac River, Lowell, Massachusetts; the Chamber of Commerce of New York; B. H. Latrobe, Esq., and the Board of Commissioners of Public Schools, Baltimore, Maryland; the New Orleans School of Medicine, New Orleans, Louisiana; the American Philosophical Society, and Professors John F. Frazer and John C. Cresson, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of May.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (7) were proposed, and the candidates (6) proposed at the last meeting were duly elected.

A. Stone & Co., sent to the meeting for the inspection of the members a sample of the air-tight jars made by them, intended for the purpose of preserving fresh fruits. The jar is of glass, with a wide mouth, in which two projections are made at points opposite each other. The cover is also of glass, and is made with a screw upon the part that goes into the mouth; two openings are cut across the screw, so that the cover may be inserted in its position. On the cover, which extends beyond the mouth, are two projections for the purpose of turning the cover so that the screw will catch under the projections in the mouth, and draw the cover down tightly upon the edges of the mouth. To insure an air-tight joint, a ring of gum is placed under the cover before it is screwed down.

Mr. Eddy, artist, of this city, presented a beautiful specimen of his work in a cabinet size picture, of a lady. The impression was first taken by the crystalotype process, and that painted in with oil colors, thus making a picture possessing all the truthfulness of the daguerreotype, with the animation, durability, and softness of oil coloring. While possessing these additional advantages, so much less time is occupied than when the drawing is done by hand, that the pictures can be made at about one-fourth the usual cost of oil painting.

The rendering wheels used upon the planes of the Mine Hill Railroad, were shown in a model laid upon the table. The wire rope, used for hauling up the cars upon this road, winds upon these wheels, and bears upon wood set endwise, so that the ends of the grain are presented to its pressure. The wood is of oak, hickory, or such wood as will not wear rapidly or crush easily, but permit a sufficient indentation of the strands to prevent slipping. The wood is held between a flanch cast on one side of the face of the wheel, and a detached ring forming a flanch on the other side, and held up with bolts. By this arrangement, a piece of defective wood can be easily removed, and its place supplied with another. The wheels have been at work for some months, and are giving satisfaction by their performance.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on an Improved Protractor, invented by Charles Gordon.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination "an Improved Protractor," invented by Charles Gordon, of Washington City, D. C.,

REPORT:—That this protractor consists of a parallel ruler of the usual form, having attached to it a semicircle graduated to any desired division of the circle. This ruler is attached to a bar by a set-screw passing through the centre of the semicircle, so that the ruler can be clamped at any angle to the bar. A vernier and a reading glass facilitate this adjustment. The bar to which the ruler is attached forms part of a heavy plate of metal which is made in the form of a triangle,

having two of its sides at right angles to each other. The weight of the plate keeps the instrument in its place upon the paper, and by setting either of its sides to coincide with any given line upon the paper, any lines may be drawn making given angles with the first or meridian line.

It is especially intended for plotting from the field notes of a compass survey, and is, for that purpose, admirably adapted, since short lines making known angles with each other or with a meridian can be very accurately and quickly laid down. The difficulty of placing the centre of the protractor exactly over the point at which the angle is laid off, which is common to all existing forms, is not present in this arrangement, where the divided semicircle turns about a mechanical axis, and not an imaginary one.

The Committee recommend the instrument as very simple, and as exceedingly useful for facilitating many varieties of a draughtsman's work.

By order of the Committee,

Philadelphia, January 9, 1859. WM. HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICES.

Geological Survey of Canada. Sir W. E. LOGAN, F. R. S., Director. Figures and Descriptions of Canadian Organic Remains. Decade III. Montreal, 1858. 2000 copies issued, of which 500 are reserved for the Legislature, and the remainder sold at a moderate price.

This pamphlet of 100 pages with eleven plates, consists of First, a Preface by Sir W. E. Logan, Director of the Geological Survey of Canada; 2d, a Memoir on the Cystideæ of the Lower Silurian Rocks of Canada, by E. Billings, Esq., F. G. S.; 3d, a Memoir on the Asteriadæ of the Lower Silurian Rocks of Canada, by the same; 4th, a Memoir on Cyclocystoides, a new genus of Echinodermata from the Lower and Middle Silurian Rocks, By J. W. Salter, Esq., F. G. S., of the Geological Survey of Great Britain, and E. Billings, Esq.; 5th, a Memoir on the Palæozoic Bivalve Entomostraca of Canada, By T. R. Jones, Esq., F. G. S.

Although called Decade III, this is the first published of a series of reports intended to illustrate the Palæontology of Canada and the northern border of the United States; new ground, and full of new and unexpected forms of ancient life; to the study of which, Mr. Billings brings an ardent zeal, a clear eye, nice analytical judgment, indefatigable diligence, and a lucid and agreeable style. He has, on this side of the water, the advantage of the friendship and co-operation of James Hall, whose collection and whose judgment are unsurpassed; and he has spent a sufficient time previous to the printing of this Decade, in England, in comparing his specimens with those in the collections of the Geological Survey of Great Britain, and his views with those of Salter, Ramsey, Murchison, Barrande, and other palæontologists of

Europe. We therefore hail the appearance of this beautiful little volume as the forerunner of an invaluable series.

Mr. Billings was appointed Palæontologist of the Canada Survey in 1856, and his first work was to arrange the museum at Montreal. It was in order and gave the liveliest satisfaction to the members of the American Association who had an opportunity of examining it at the Montreal meeting in 1857. Lofty cases round the rooms exhibit the larger specimens, and glass-covered tables occupying the central spaces cover piles of drawers, full of the treasures which we expect to see portrayed and described in these decades. Into the walls of the landing places in the staircase hall are set numerous huge slabs of sandstone on which are seen rows of foot tracks, upon ripple-marked surfaces, pitted with the marks of rain drops, scratched in compound lines by small crustaceans, or trailed over by aboriginal worms. Into this museum have been thrown for the last two years the very numerous contributions from the extreme east of Canada, Anticosta, and Newfoundland; and among them, a unique collection of those wonderful creatures, the Silurian Graptolites, to be described by Hall.

We are glad to learn from the preface of the Decade, that twenty-four species of these and allied genera from the Hudson river group, drawn by Meek, and engraved on steel by Gavit, will be given by Hall in Decade II, commenced in 1855. A preliminary description of these was published in the Report of Progress in 1857. Decade I was confided in 1855 to Salter, the well-known English palæontologist, and must by this time be in the printer's hand. Its plates are by Sowerby from drawings by Bone; and its object is to exhibit the commingling at one locality of forms heretofore supposed to belong to distinct epochs. We admire this fresh example of the fearlessness of true science. Palæontologists are disposed to slight the argument from lithological constitution and mineral sequence for identifying rocks over wide intervals, and to put their whole trust in the outspread and sequence of animal forms. Structural geologists, on the other hand, are too tenacious of mere color and composition as sufficient clues to lead inquirers through the maze of broken ground. Every discovery of a fossil genus or species fixed at one horizon, and not discoverable above or underneath it, is a blow given to structural bigotry; and conversely, every discovery such as the one described above, to be presented in the first Decade of the Canada Survey, of a mixing up of earlier and later forms in the same bed, or in a known cotemporaneous deposit, is a still harder blow given to the still more mischievous bigotry of the mere palæontologist. But when a man is found, who is both a structural and a fossil geologist like James Hall or Sir William Logan, science is allowed to speak for herself, and then she harmonizes all.

The Decade before us gives us beautiful and copious delineations of a class of extinct forms which has of late excited a new interest. In the order of forms, the cystideans come between the fixed stone-lilies, encrinites, &c., and the floating trilobites; some are flat and some are round, globular or ovoid, and even cylindrical, but they all remind the spectator at once of the trilobite, and of the encrinite. Their lowest

forms had a hard tesselated back on one side, and a flexible and also tesselated, or we may almost call it, shagreened calcareous belly on the other side; and they were supported on a sort of tapering stem tail, composed like the foot-stalk of the stone-lilies, of numerous joints. At the apex waved two tapering jointed horns or arms, and certain small holes or slits, noticeable between the horns, or notched into the edges of the back plates, are considered by Mr. Billings to have been both mouth and anus. Some of these lower forms resemble the head of a viper, especially on the under side. As we ascend in the scale, the cystid becomes very beautiful, sculptured with radiating ridges and mathematical figures, and crocketed like a gothic pinnacle along the edges. This effect is produced by the falling of the arms down against the body. Some of the species have no arms at all as seen in the fossil condition, but are grooved from the summit downward, showing where their flexible, soft, and perhaps gelatinous arms originally lay. Some of these *Glyptocystites* are models for a designer. Still higher in the scale we find globular cystidæ, pitted like strawberries, (*comarocystites*,) or elongated like almonds, (*amygdalocystides*,) and adorned with arms which are themselves armed so that these creatures appear to have waved flexible stony plumes before them. The pits are sunk like the rosette panels in the vault surface of St. Peter's, and are exquisitely sculptured. In the apple-formed *malocystites* these plumed arms fall against and ramify over the globe, covering it with a charming net work.

For the internal structure of these curious beings, and the way they reproduced their young, along their arms like starfish, or in the manner of ferns in the vegetable kingdom, we must refer the reader to the text of Mr. Billings.

That the cystidean idea passes up into that of the starfish, is evident at a glance at the plates which illustrate Mr. Billings' paper on the Asteriadæ. Plate VIII shows us globular forms of tesselated stony matter with five arms tightly bound down upon the surface; arms which bear a perfect general likeness to those of a starfish of the present day. Plate IX shows the whole globe absorbed into the five arms, and Plate X gives still further developed forms of the most elegant character, in which the arms exist alone like expanded flowers. Plate XI exhibits the last and strangest metamorphosis of all, in which the arms sink back upon a disc like a half dollar, with tracery radiating from the centre to the ornamented edge, and bifurcating again and again like a brilliant design for a cathedral rose window. We recommend to Hunt or Notman the figure 5* b Plate X for the next great rose window they require.

Murchison in his last edition of the Siluria, London, 1859, gives on page 245, a number of small cuts of the cystideæ of the Wenlock limestone, (Upper Silurian,) one of which, *Pseudocrinites magnificus*, might have been called quite as appropriately *horridus* or *caput medusæ*, for it is entirely surrounded by waving matted stony locks of arms.

The subject leads us directly into that world of late investigation, the Crinoideæ, of which the two volumes of the Iowa Survey just pub-

lished by Hall, and the third volume of the Kentucky Survey published last year by Owen, furnish the freshest illustrations. We will speak of these hereafter. L.

The Chemistry and Metallurgy of Copper, including a description of the principal Copper Mines of the United States, &c., &c. By A. Snowden Piggot, M. D., Philadelphia: Lindsay & Blakiston, 1858.

This duodecimo of 388 pages is one of those complete little manuals which the practical genius of modern science has been furnishing of late years to the mere working world, and the value of which cannot be estimated except by the necessities of those who find themselves involuntarily consulting them upon all occasions. A few paragraphs and a few wood-cuts on this or on that question, to elucidate this or that difficulty, are very little to the reading or even to the thinking world, but are everything to the student, who blesses every stray ray of light, and to the workman wondering where the man lives who was ever troubled as he is, or who can show him the way out of his perplexities. If the present age differs from preceding ages in any trait of its life form, this may be stated as its characteristic difference, that it sums up, states curtly, and illustrates clearly, the practical scientific materials, provided by the past and perfected by the present, for every employment of man, in its hand-books for every country, science, and art. The book before us has seven chapters: the first devoted to the chemical relations of copper, the second to the ores, the third to their analysis, the fourth to mines and mining in general, the fifth to copper mines in particular, the sixth to copper smelting, and the seventh to the alloys of copper used or useful in the arts. The chemical compounds of the metal are given, therefore, in two forms, first as they are produced or reduced in the laboratory, and then as they appear in the great laboratory of the earth-crust in three of the four classes of copper ores, native copper constituting a first class by itself. The other three classes are the oxides and chlorides, the compounds with sulphur, selenium, arsenic, and antimony, and the numerous and heterogeneous compounds of copper with the remaining elements. It is curious to see how almost exactly sulphur and oxygen replace each other in their alliance with copper; normal copper glance being 79·8 Cu + 20·2 S, and 79·86 Cu + 20·13 O being normal black oxide. In a geological point of view, the most important ore of copper is the pyrites or double sulphuret of iron and copper, 34·47 Cu + 30·48 Fe + 35·05 S = Cu_2 S + Fe_2 S_3. This mixed with the red oxide forms the ore described on page 275.

The analysis and assay of copper ore are fully treated in 52 pages. Chapter third contains 50 pages on general mining, in which the author states and illustrates his views of the formation of mineral veins, and evidently leans to the theory of *lateral secretion*. The fourth chapter describes the geographical distribution of copper ores; first, in the old world and South America, and then more elaborately in the Lake Superior region, the Mississippi Valley region, and the region of the

Atlantic States, after the arrangement of Whitney. Twenty pages are devoted to these three regions. The table on page 241, brings the yield of the East Cliff mines down to 1855, and the dividends of the Company to 1856. The table on 249 brings down the yield of the Minnesota also to 1855, and we notice that this is about the limit of statistical information, as to time, in this section. Every mine opened at that date is mentioned and described more or less in detail. The Silurian ores of Wisconsin and Missouri deserve and receive but a slight mention. Dr. Piggot then begins at Maine, and descends the Atlantic seaboard to Georgia, noticing chiefly the copper lodes of Virginia and Eastern Tennessee, and ending with the copper mines of the New Red Sandstone of New Jersey and Pennsylvania. In some cases the statistics come forward to 1857, and important modifications of the first opinions formed of some of these exhibitions of copper are shown by subsequent experimental work to be necessary. We point to the Manasses gap mine as a warning, how needful a proper examination and method of attacking a vein is, to justify proceedings upon even the best chemical analysis of hand specimens. Veins lately discovered in the same neighborhood, and with even a finer show of copper than the Manasses gap outcrop made, will lead to the same results unless due care be taken to insure preliminary knowledge of the ground.

The fifth chapter on smelting copper, gives in great detail (from Muspratt) the English process pursued at Swansea, with cuts of furnaces and descriptions of the ten successive operations. Then the patent processes of Napier, Brankart, Rivot & Phillips, Davies, Birkmyre, De Sussex, Low, &c., with the objections to them; the French method pursued at Chessy, near Lyons; and finally, the smelting of the Mansfield copper schists in Germany, with pictures of the apparatus.

The last chapter on the practical alloys, and the Appendix of tables of statistics, are of considerable interest to the general reader, and advance the statistics of the production of Cornwall to 1857. L.

The Iron Manufacturer's Guide to the Furnaces, Forges, and Rolling Mills of the United States, with discussions of Iron as a Chemical element, an American ore, and a manufactured article, in Commerce and in History. By J. P. Lesley, Secretary of the American Iron Association, and published by the authority of the same, with maps and plates. New York: John Wiley. London: Milner & Co., 1859. 8vo., pp. 772.

As indicated by its title, and more fully in its preface, this work is intended as a manual of important information to every one concerned in the manufacture or use of iron. It divides itself naturally into two parts. First, a directory intended to give the location and general statistics of all iron works in the United States and Canada, classified as furnaces, forges, and rolling mills. This portion, which has required great labor and perseverance in acquiring the information thus communicated, occupies 262 pages, and is illustrated by four maps;

two of which are very good specimens of the new process of photography as applied to lithography. This valuable mass of information for every one in any way concerned in the use of iron, is due to the enterprise of the American Iron Association, a company which has done much valuable service to the arts and industry of our country, and deserves the encouragement of every American. The second part of the book consists of a practical treatise upon iron, and its ores. The treatise on iron as a chemical element will be found to be a very carefully elaborated digest of almost every thing of value which has been written upon iron, since its great importance has been recognised. The account of the ores is divided into chapters on the primary ores, the brown hæmatite, the fossil ore, the carbonates, and the bog ore; and under each head are given the principal localities, the mode in which the ore lies, and its gangues; the theory of its occurrence, the modes of working it, and the results of these various methods so far as they can be reached. This portion will be found of great interest not only to the practical iron worker, but to every one who takes an interest in the natural history of our country, and especially to the geologist and mineralogist.

The third and fourth divisions have been pressed out by want of space, and will form the subject of a subsequent publication. They include the discussion of iron as an American manufacture, and in American history. Some twenty pages are, however, occupied with the statistics of the manufacture as collected by the Association, and the results are, as far as possible, digested in tables which give much valuable information upon this, the most important branch of our manufactures.

It is not our intention now to discuss the peculiar theories of Mr. Lesley, or of the authors whom he quotes with approbation—but to express our high approbation of the intelligence, zeal, and perseverance which are indicated in the preparation of this work, and to recommend it, and the subjects of which it treats, and the Association under whose auspices it is published, to the familiar attention of our readers. ED.

Conservatory Journal; devoted to establishing a Massachusetts Conservatory of Arts, Science, and Historical Relics.

The gentlemen of Boston who feel an interest in the education and elevation of the people, have determined to establish in their city an institution similar to the Zoological Garden of London, and the Jardin des Plantes of Paris. The newspaper whose title we give above, is devoted to the furtherance of this object, and undoubtedly in a city so famous for the liberality and public spirit of its citizens, their efforts will be successful. Such a project has been smouldering in our city for years, but is not likely ever to rise above an *eremacausis*. We hope our neighbors will show us the way, and compel us to follow.

F.